# FINAL EXAMINATION VERSION A

INSTRUCTIONS: This exam is closed-book, closed-notes. Simple calculators are permitted, but graphing calculators, calculators with alphabetical keyboards, wireless devices and mobile phones 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, 26 pts total]

(1) "The inflation rate has remained below 3 percent for a decade" is an example of
a.   a positive statement.
b.   a normative statement.
c.   both of the above.
d.   none of the above.

(2) Is the production function below characterized by diminishing returns to labor input?
a.   Yes, for all levels of labor input.
b.   No, not for any levels of labor input.
c.   Yes, but only after 6 hours of labor input.
d.   Yes, but only before 6 hours of labor input.
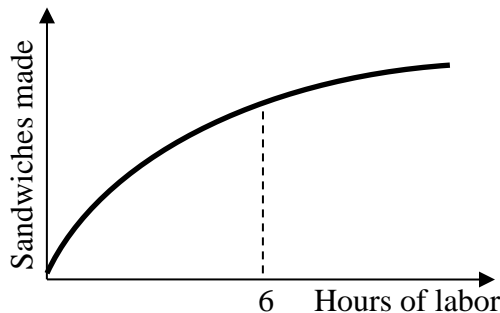
(3) Farm A can produce 100 units of corn or 100 units of soybeans per acre. Farm B can produce 300 units of corn or 150 units of soybeans per acre. Which farm has a comparative advantage in corn?
a.   Farm A.
b.   Farm B.
c.   Both farms.
d.   Neither farm.

(4) 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.

(5) As the price of gasoline falls, consumers are buying more large sport-utility vehicles, because gasoline and SUVs are
a.   substitute goods.
b.   complementary goods.
c.   inferior goods.
d.   normal goods.

(6) A good that has close substitutes will likely have a price elasticity of demand that is
a.   small, in absolute value.
b.   large, in absolute value.
c.   zero.
d.   infinite.
e.   cannot be determined.

(7) The supply curve in the graph below is
a.   perfectly elastic.
b.   perfectly inelastic.
c.   unitary elastic.
d.   Cannot be determined from information given.
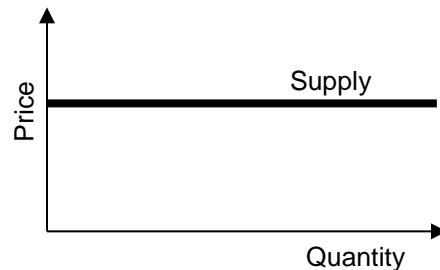
(8) To pass the *compensation test of Kaldor and Hicks*, a change in the economy must result in
a.   winners but no losers.
b.   gains to winners that exceed any losses to losers.
c.   at least some winners.
d.   cost savings for the government.
e.   a rise in wages, salaries, and other compensation.

(9) Suppose the price of a watermelon in Des Moines is $4 and the cost of shipping a watermelon between Des Moines and Minneapolis is $1.50. Markets are *in equilibrium* if the price of watermelons in Minneapolis is
a. $2.
b. $5.
c. $8.
d. $11.

(10) Consider the market for sandwiches depicted in the graph below. Suppose a law is passed prohibiting *buyers from buying* more than 200 sandwiches. With this quota, the price of sandwiches will be
a. $1.
b. $3.
c. $4.
d. $5.
e.   Cannot be determined from information given.
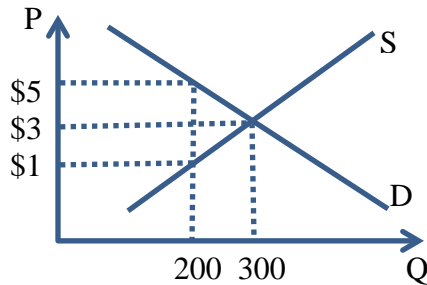
(11) A change in the amount of bottled water each person buys is called a change at the
a.   extensive margin.
b.   intensive margin.
c.   marginal product.
d.   marginal revenue.

(12) Zippy Lube currently changes oil on 100 cars a day, and its daily cost of operation is $6000. If it expands its business to 200 cars a day, its daily cost will rise to $10,000. Its marginal cost over this range is therefore about
a. $30 per oil change.
b. $40 per oil change.
c. $50 per oil change.
d. $60 per oil change.
e. $100 per oil change.
f.   Cannot be determined from information given.

(13) ABC Company is a small firm in a big market 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
a.   40 units.
b.   50 units.
c.   60 units.
d.   70 units.
e.   80 units.
f.   Cannot be determined without knowing market price.
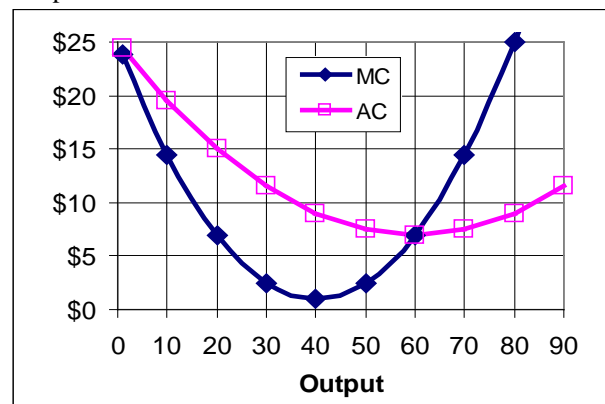
(14) In the *short run*, a firm should continue operating if its revenue is sufficient to pay at least its
a.   fixed cost.
b.   variable cost.
c.   total cost.
d.   accounting cost.

(15) *Price equals marginal cost* in a competitive industry in both short-run and long-run equilibrium because
a. business owners have a sense of fairness.
b. individual firms adjust their output levels 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.

(16) Suppose the paper industry is perfectly competitive and the price of a ream of paper is $5. Then any firm in the paper industry believes its marginal revenue is
a. more than $5.
b. less than $5.
c. exactly equal to $5.
d. zero.

(17) Suppose the price of a pair of jeans is $30 and the price of a teeshirt is $5. If the economy is perfectly competitive, then these prices indicate that the *economy's* opportunity cost of a teeshirt is
a. 1/5 of a pair of jeans.
b. 1/6 of a pair of jeans.
c. 1 pair of jeans.
d. 5 pairs of jeans.
e. 6 pairs of jeans.

(18) Which average cost curve below implies that the firm enjoys a natural monopoly?
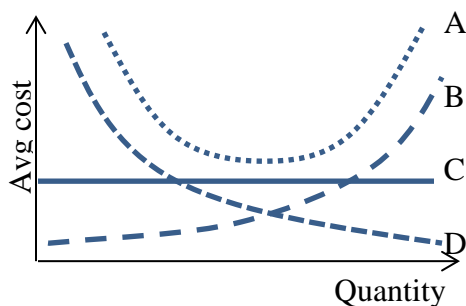
a. Curve A.
b. Curve B.
c. Curve C.
d. Curve D.
e. None of the above.

(19) Suppose a hotdog vendor sells 20 hotdogs per hour if the price is $2, and sells 21 hotdogs if the price is $1.95. The vendor's marginal revenue of the 21st hotdog is therefore
a. $0.05 .
b. $0.95 .
c. $1.00 .
d. $1.95 .
e. $2.00 .
f. $20.00 .

(20) Products are said to be "differentiated" if
a. one can buy them in fractional amounts.
b. consumers do not view them as perfect substitutes.
c. they are sold through different retail channels (stores, online, catalogs, etc.)
d. different consumers buy different quantities of them.

(21) It has been suggested that hydraulic fracturing ("fracking"), a technique of drilling for oil or gas, may cause small earthquakes that damage buildings (not owned by the drilling company). If this is true, then hydraulic fracturing creates
a. an external benefit.
b. an external cost.
c. a necessary good.
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) Suppose the marginal private cost of producing a ton coal is $40 and the marginal social cost is $100. Then the marginal external cost is
a. $20.
b. $40.
c. $60.
d. $80.
e. $100.

(24) 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.

(25) Newspapers like the *Wall Street Journal* and the *New York Times* offer online versions. Many people can access the online versions without interfering with each other. However, the newspapers can require viewers to pay for access. An online newspaper is therefore
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(26) Absent some sort of regulation, common property resources are inevitably
a. underused.
b. overused.
c. ignored.
d. produced in excessive quantity.

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 trims trees. 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	Trees trimmed per day	Average Product	Marginal Product
0 workers	0 trees trimmed		
			trees trimmed per worker
3 workers	18 trees trimmed	trees trimmed per worker	
			trees trimmed per worker
6 workers	24 trees trimmed	trees trimmed per worker	
			trees trimmed per worker
9 workers	27 trees trimmed	trees trimmed 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 X and Country Y can each produce dining-room tables and scooters. They each face a tradeoff between these two products because of limited workforces. Their production possibility curves are shown below.
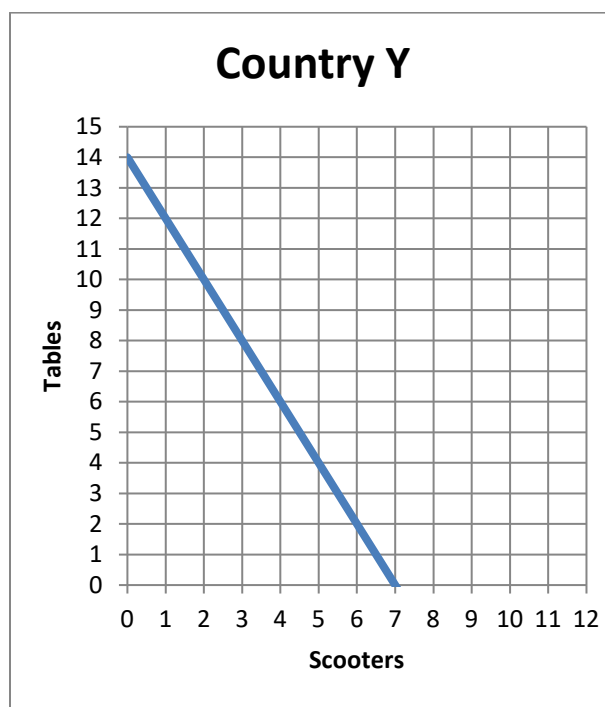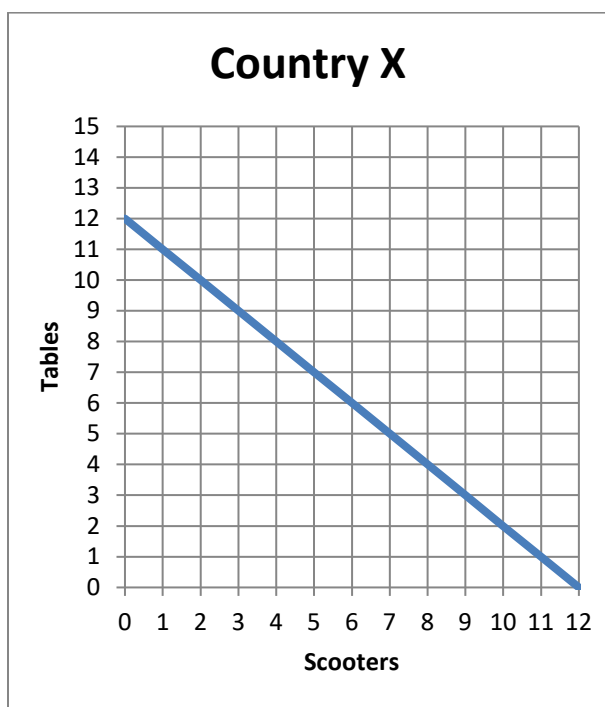
Country X

Country Y

a. What is Country X's opportunity cost of producing a table?

b. What is Country Y's opportunity cost of producing a table?

c. What is Country X's opportunity cost of producing a scooter?

d. What is Country Y's opportunity cost of producing a scooter?

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

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

	scooters
	scooters
	tables
	tables

g. [3 pts] Fill in the blanks: *Both* countries can consume combinations of products *outside* their individual

production possibility curves if _____ exports *three* tables to

_____, which exports _____ scooters 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) [Shifts in demand and supply: 15 pts] Analyze each of the following markets according to the accompanying imaginary scenario.

a. Consider the market for *hybrid cars*: The price of gasoline rises. (Hybrid cars use very little gasoline.)
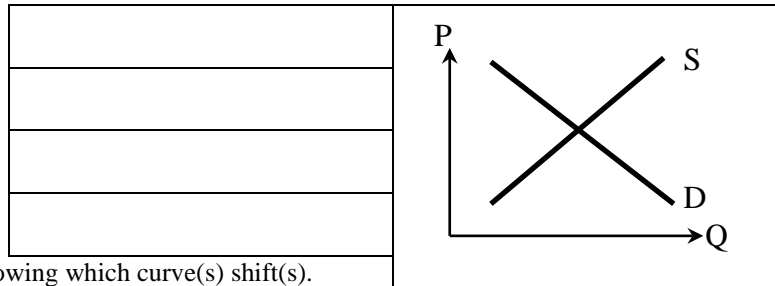
Does demand shift *left*, shift *right*, or remain *unchanged* ?
Does supply shift *left*, shift *right*, or remain *unchanged* ?
Does the equilibrium price *increase, decrease,* or *cannot be determined* ?
Does the equilibrium quantity *increase, decrease,* or *cannot be determined* ?
Sketch a graph of this scenario at right, showing which curve(s) shift(s).
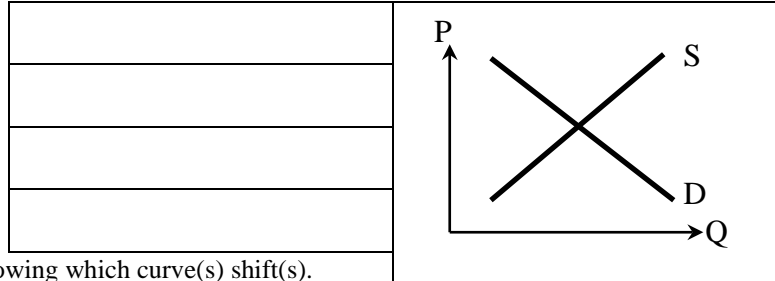
b. Consider the market for *corn*: Excellent weather increases the corn harvest.

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 *cars*: A recession causes consumers' incomes to fall. Simultaneously, car companies discover new ways to make cars more cheaply.

Does demand shift *left*, shift *right*, or remain *unchanged* ?
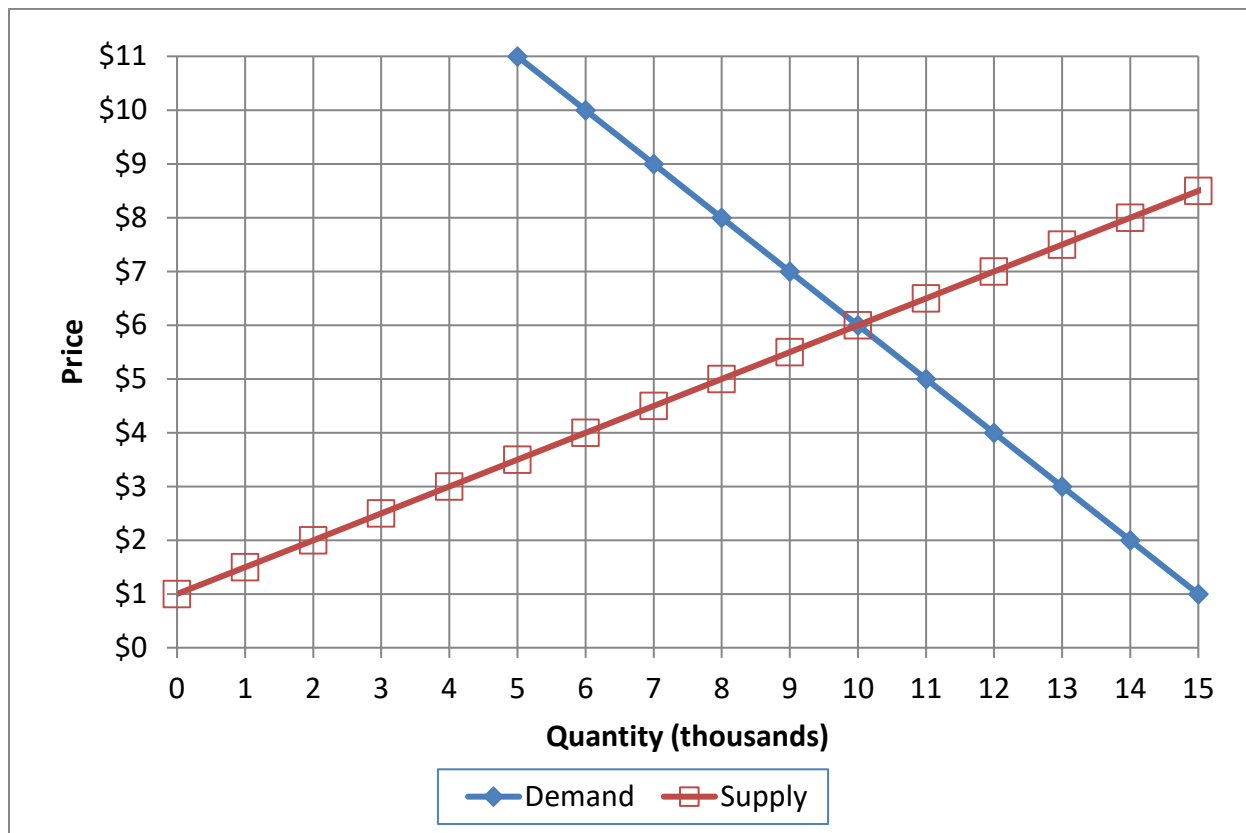Does supply shift *left*, shift *right*, or remain *unchanged* ?
Does the equilibrium price *increase, decrease,* or *cannot be determined* ?
Does the equilibrium quantity *increase, decrease,* or *cannot be determined* ?
Sketch a graph of this scenario at right, showing which curve(s) shift(s).
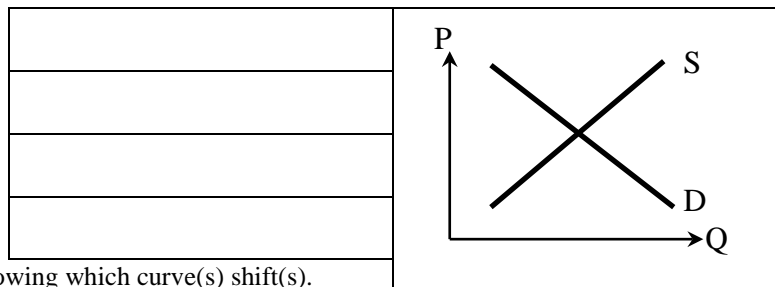
(4) [Welfare analysis of tax or subsidy: 18 pts] The graph below shows the market for snow shovels.


Suppose the government pays a **subsidy of $ 3** per snow shovel.

a. Compute the equilibrium quantity sold.	thousand
b. Compute the equilibrium total price received by sellers (including the subsidy).	$ per shovel
c. Compute the equilibrium net price paid by buyers (excluding the subsidy).	$ per shovel
d. Does producer surplus *increase, decrease,* or *remain constant* because of the subsidy?	
e. By how much?	$ thousand
f. Does consumer surplus *increase, decrease,* or *remain constant* because of the subsidy?	
g. By how much?	$ thousand
h. Compute the direct cost of the subsidy to the government—that is, the amount that the government will have to pay buyers and sellers.	$ thousand
i. Compute the deadweight social loss caused by the subsidy.	$ thousand

(5) [Consumer choice and demand: 14 pts] The indifference curves in the graph below represent Jason's preferences for lattes and cupcakes.
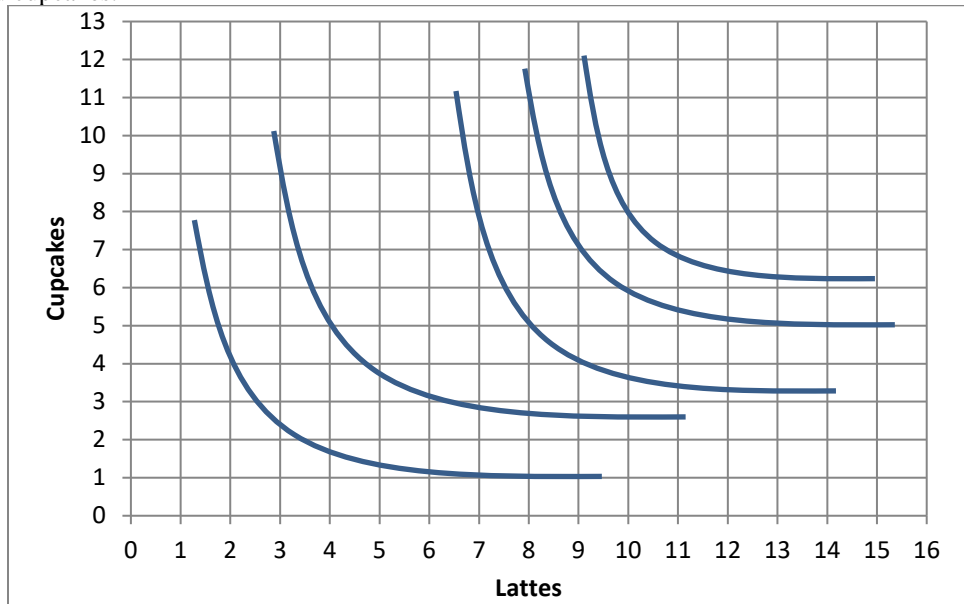
a. Would Jason rather have 5 cupcakes and 15 lattes, or 8 cupcakes and 10 lattes?

cupcakes and	lattes
cupcakes and	lattes

b. Would Jason rather have 1 cupcake and 9 lattes, or 5 cupcakes and 4 lattes?

Suppose Jason has a budget of $30 to spend on cupcakes and lattes. The price of lattes is $2.

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

d. How many cupcakes will Jason buy if the price of cupcakes is $6?

cupcakes

e. **Using a straightedge**, carefully draw Jason's budget line when the price of cupcakes is $3. Label this budget line "B".

f. How many cupcakes will Jason buy if the price of cupcakes is $3?

cupcakes

g. Plot two points on Jason's demand curve for cupcakes, and sketch Jason's demand curve at right.
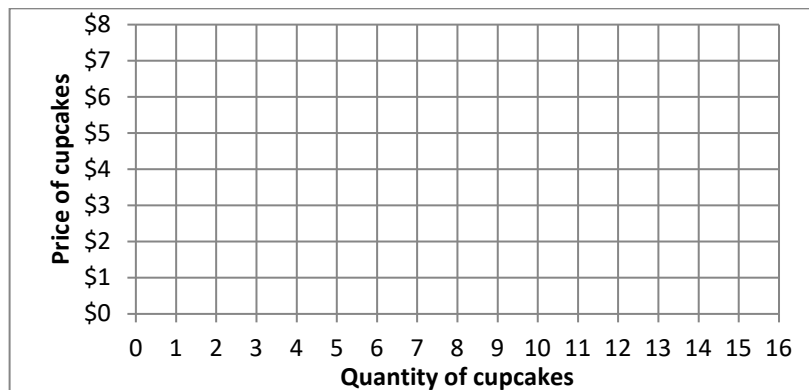
(6) [Using income elasticities: 10 pts] Suppose the income elasticity of demand for gasoline is 0.75. Now suppose income *rises* by 4%. Assume the price of gasoline does not change.

a. According to the information above, is gasoline a *necessary good*, an *inferior good*, or a *luxury (or superior) good*?

b. As income rises, will the quantity of gasoline demanded *increase*, *decrease*, or remain *constant*?

c. ... by about how much?

%

d. Will consumer spending on gasoline, as a fraction of a consumer's total budget, *increase*, *decrease*, or remain *constant*?

e. ... by about how much?

%

(7) [Rational choice: 10 pts] The city government for a rapidly growing city needs to build new fire stations. The following are cost and benefit estimates.

Fire stations	Total cost	Total benefit	Marginal cost per station	Marginal benefit per station
0	$ 0	$0		
			$ million	$ million
2	$8 million	$20 million		
			$ million	$ million
4	$14 million	$28 million		
			$ million	$ million
6	$18 million	$34 million		
			$ million	$ million
8	$22 million	$36 million		

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 fire stations should the city build? (Answer must be 0, 2, 4, 6, or 8).

stations

(8) [Business revenue and cost—definitions: 3 pts] Insert the appropriate term from the list below in each box. The same term may be entered in more than one box.

Total revenue   Average revenue   Marginal revenue
Total cost   Average cost   Marginal cost

a. Slope of total cost curve.

b. Price times quantity of output.

c. Increase in total cost from producing one more unit of output.

(9) [Economy-wide efficiency: 14 pts] The graph below shows a country's production possibility curve.

Production-possibility curve

(Clothing (billions) vs Food (billions))
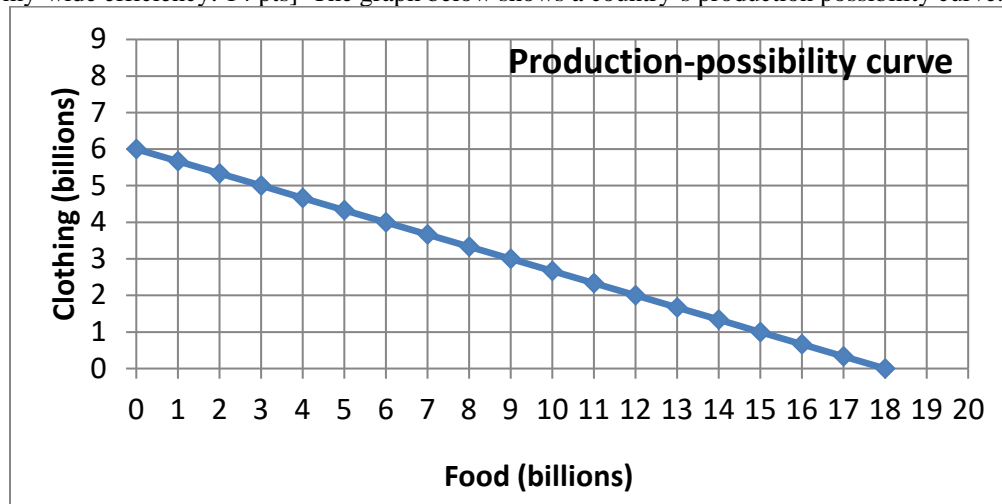
a. What is this **country's** opportunity cost of a unit of food?

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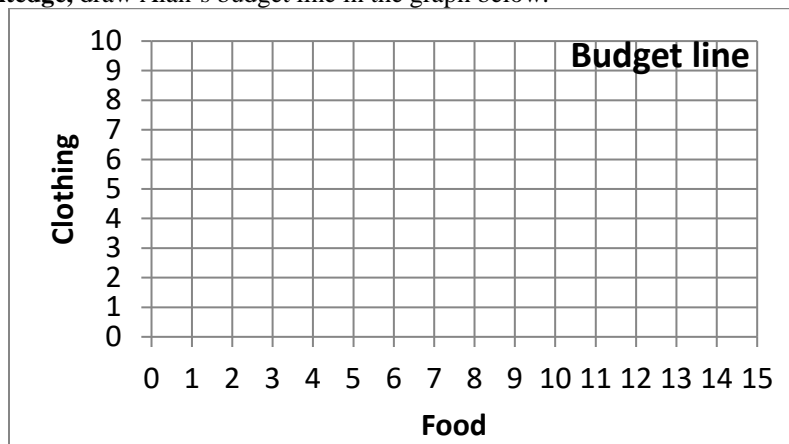
| units of clothing |
| units of food |

Assume this country's economy is in competitive equilibrium in all markets and the price of a unit of clothing is $6.
  c. What must be the price of a unit of food?

| $ |

Alan is a consumer in this economy. He has an income of **$ 30**.
  d. **Using a straightedge,** draw Alan's budget line in the graph below.

Budget line

(Clothing vs Food)

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

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

| units of clothing |
| units of food |

g. Sketch an indifference curve tangent to Alan's budget line. What is the
   slope of that indifference curve (that is, Alan's marginal rate of substitution)
   at the tangency point?

(10) [Monopoly price discrimination: 4 pts] Suppose the only movie theatre in town sells tickets to both children and adults. The theatre believes the elasticity of demand by children is –6, and the elasticity of demand by adults is –2. Assume the theatre's marginal cost of a ticket is $10.

a. Compute the profit-maximizing ticket price for children.

$

b. Compute the profit-maximizing ticket price for adults.

$

(11) [Competition versus collusion: 16 pts] Suppose a small group of firms produce a certain vitamin. The graph below shows the demand curve for the vitamin, and the joint marginal cost or supply curve of the group of firms.
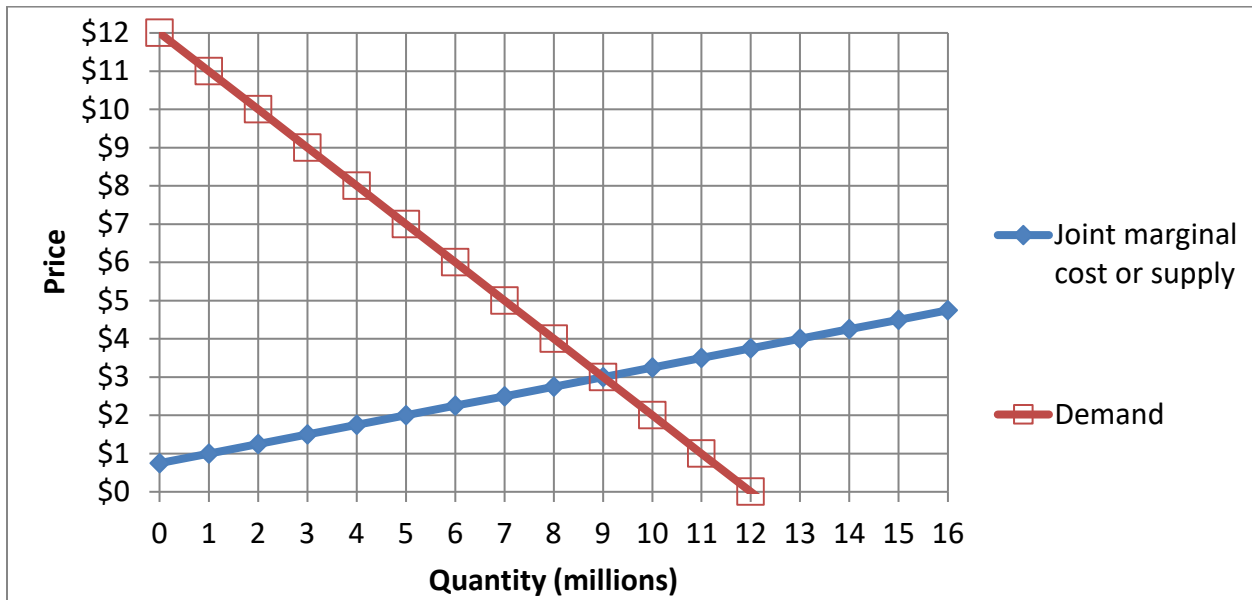
First, assume the firms *compete* with each other, each maximizing its own profit while taking the market price as given.

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 deadweight loss from collusion.

$ million

(12) [Externalities: 12 pts] The graph below shows the market for a particular vaccine. 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.
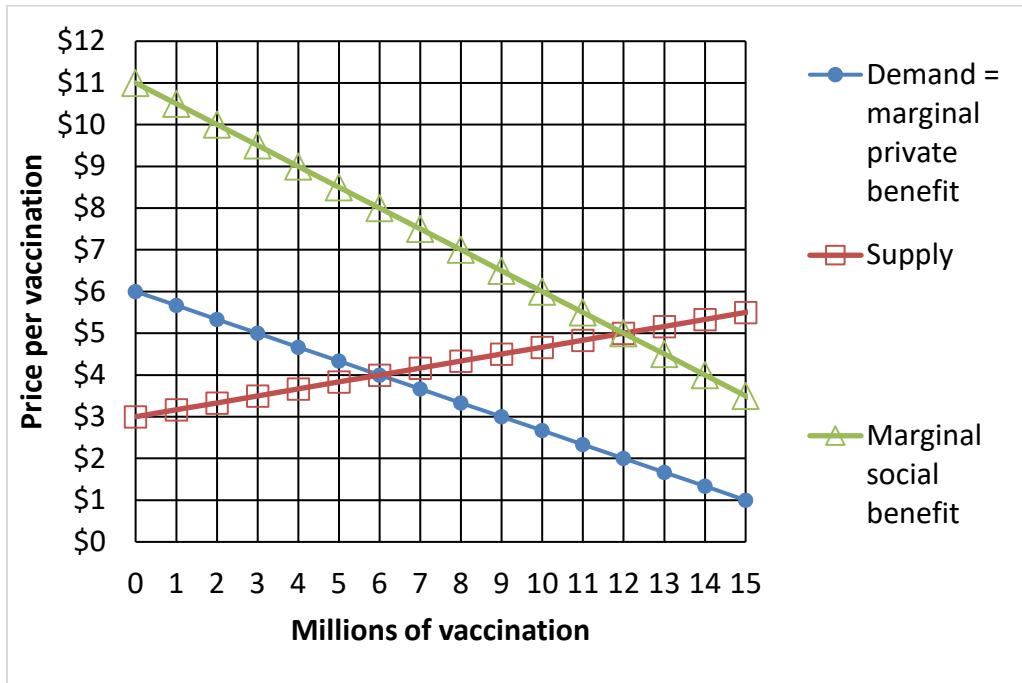
a. Compute the (unregulated) competitive equilibrium price.

b. Compute the (unregulated) competitive equilibrium quantity.

c. Compute the economically efficient (or socially optimal) quantity.

d. Compute the deadweight loss from unregulated competition.

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?

$	
	million
	million
$	million
$	per vaccination

(13) [Regulating pollution: 20 pts] Six factories are each producing one unit of pollution per year. The government has determined that total pollution must be reduced to **2** units per year (a reduction of **4** units). The cost of cleaning up pollution at each factory is given below.

| Factory	A	B	C	D	E	F
Annual cost of cleaning up pollution	$5	$25	$45	$35	$15	$55

Command-and-control:
  a. To minimize the total cost of cleaning up, which **4** factories should be commanded to clean up? Give their letters.

  b. What would be the total cost of cleaning up for these **4** 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 **2** permits (or waivers) to pollute were sold by the government to factories at auction.

  c. [6 pts] Draw the factories' demand curve for permits in the graph at right. (Be sure to draw correct "stairsteps.")
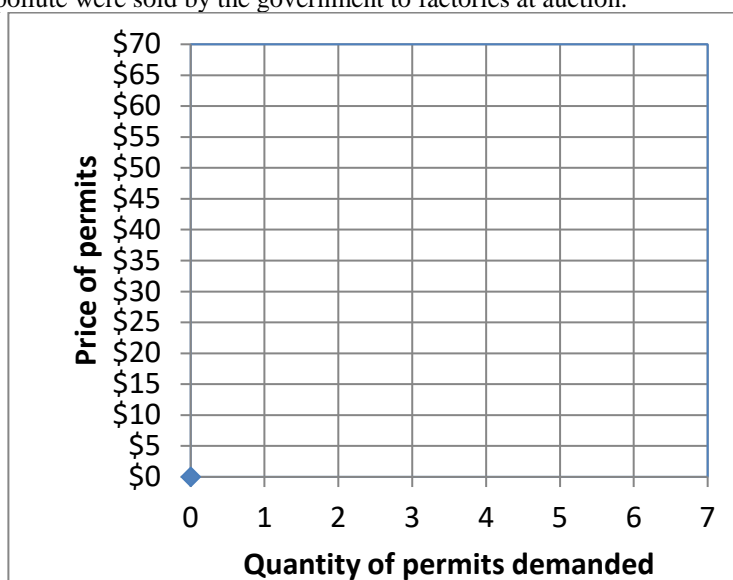
In this auction, the price starts at $0 and rises in increments of $10.
  d. Which **2** factories would win the permits? Give their letters.

  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 **4** 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 **2** units: $0, $10, $20, $30, $40, or $50 ? $

 h. What would be the total cost of cleaning up for those **4** factories that chose not to pay the fee? $

(14) [Public goods: 4 pts] A village government will offer a free outdoor movie series during the summer in a neighborhood park. About **500** people are likely to enjoy the movies. Each movie costs $**1000** to show. Let Q denote the number of movies. A typical individual person's marginal benefit from the movie series is given by the following expression (or formula): **MB = 8 – Q** .

a. Give an expression (or formula) for the marginal social benefit from the movie series. [Hint: This must be a formula containing one variable: Q.]

b. Compute Q* the socially-optimal number of movies.

MSB =
movies

(15) [Common property resources: 6 pts] A certain freeway can easily get 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 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.
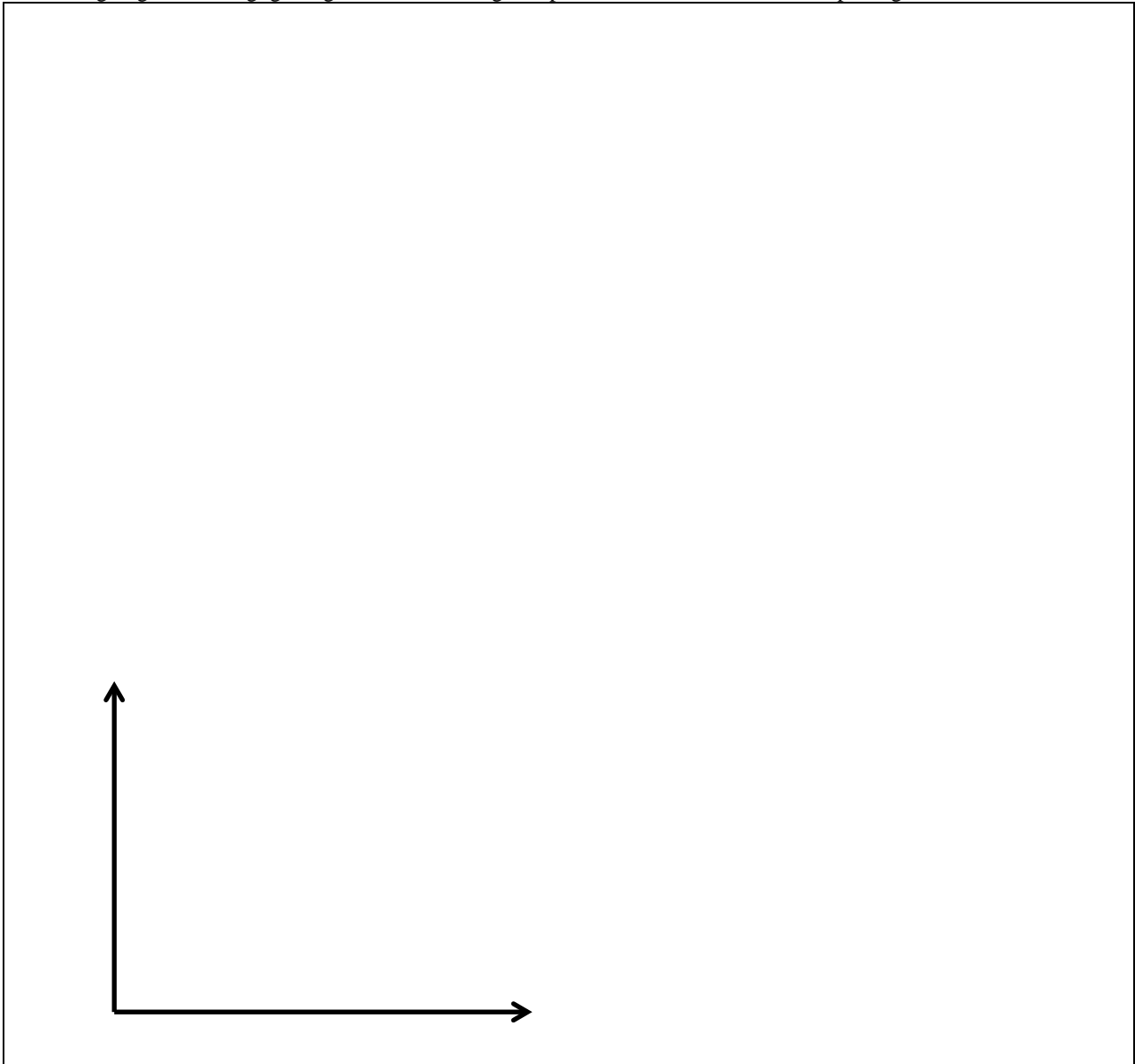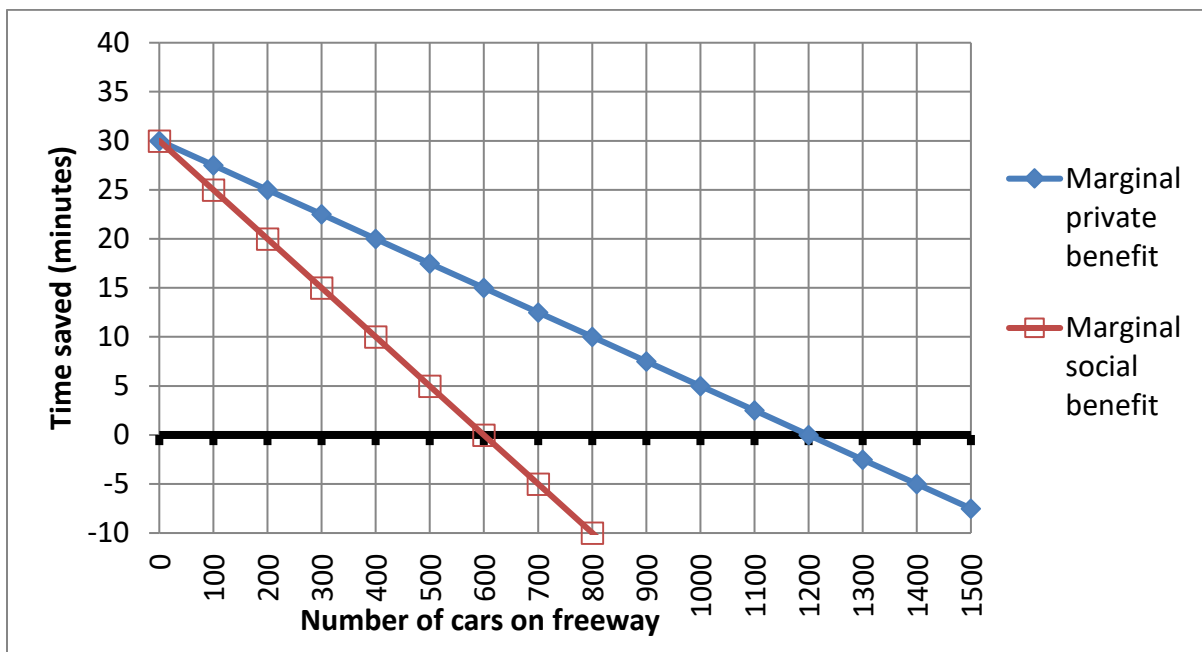

a. How many cars will enter the freeway if entry onto the freeway is unregulated?

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
$	

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 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 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]