

**ECONOMICS 211: INTRODUCTORY MICROECONOMIC THEORY**

**Fall 2006**

American University of Beirut  
Department of Economics

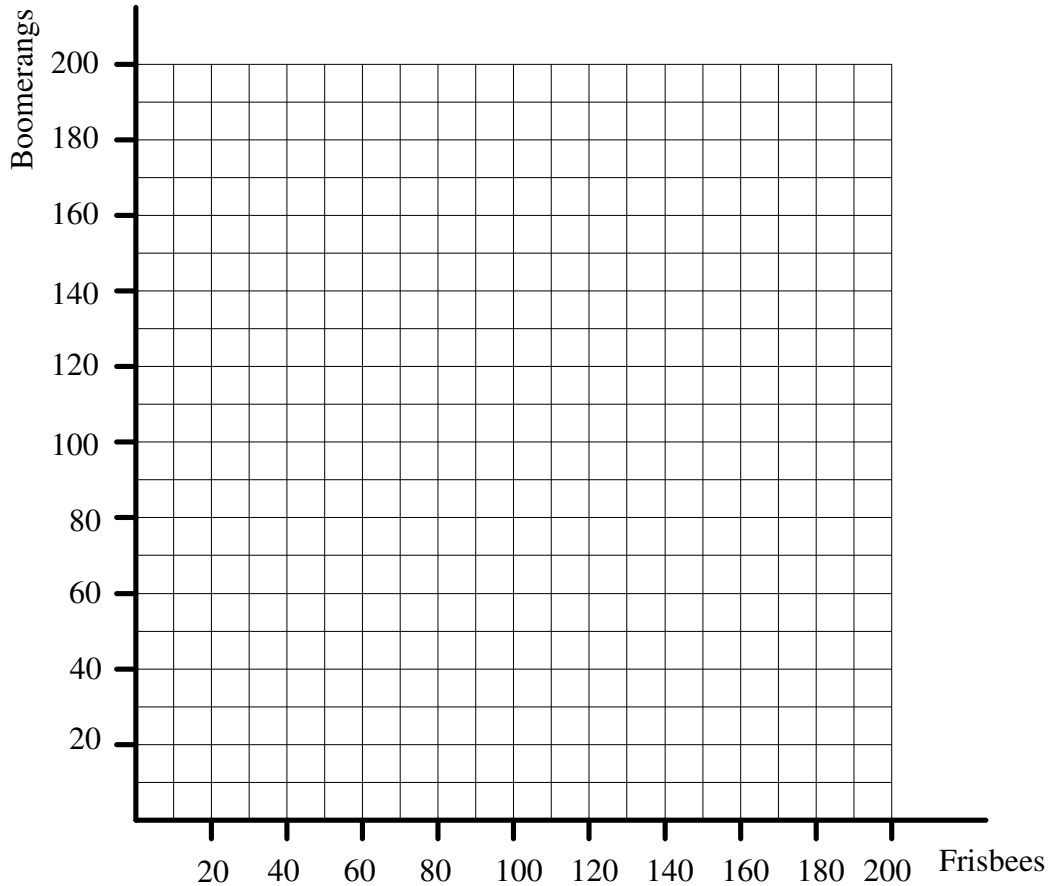
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## CHAPTER 2: THE ECONOMIC PROBLEM: SCARCITY AND CHOICE

### Problem 1: Production Possibility Frontier I

	A	B	C	D	E	F	G
Frisbees	0	45	80	110	130	145	150
Boomerangs	200	190	170	140	100	50	0



Assume that points A, B, C, D, E, and F lie on AUB's production possibility frontier (PPF). AUB's PPF is composed of a series of line segments, each joining a pair of "adjacent" points.

- Draw AUB's PPF
- What is the opportunity cost of producing an extra boomerang between zero and 50 boomerangs. Between 50 and 100? Between 100 and 140? Between 140 and 170? Between 170 and 190? Between 190 and 200?
- What is the opportunity cost of an additional Frisbee when 130 frisbees are produced.
- Do the opportunity costs of producing a boomerangs increase, decrease, or remain constant as the production of boomerangs increase?

### **Problem 1: Production Possibility Frontier I (Continued)**

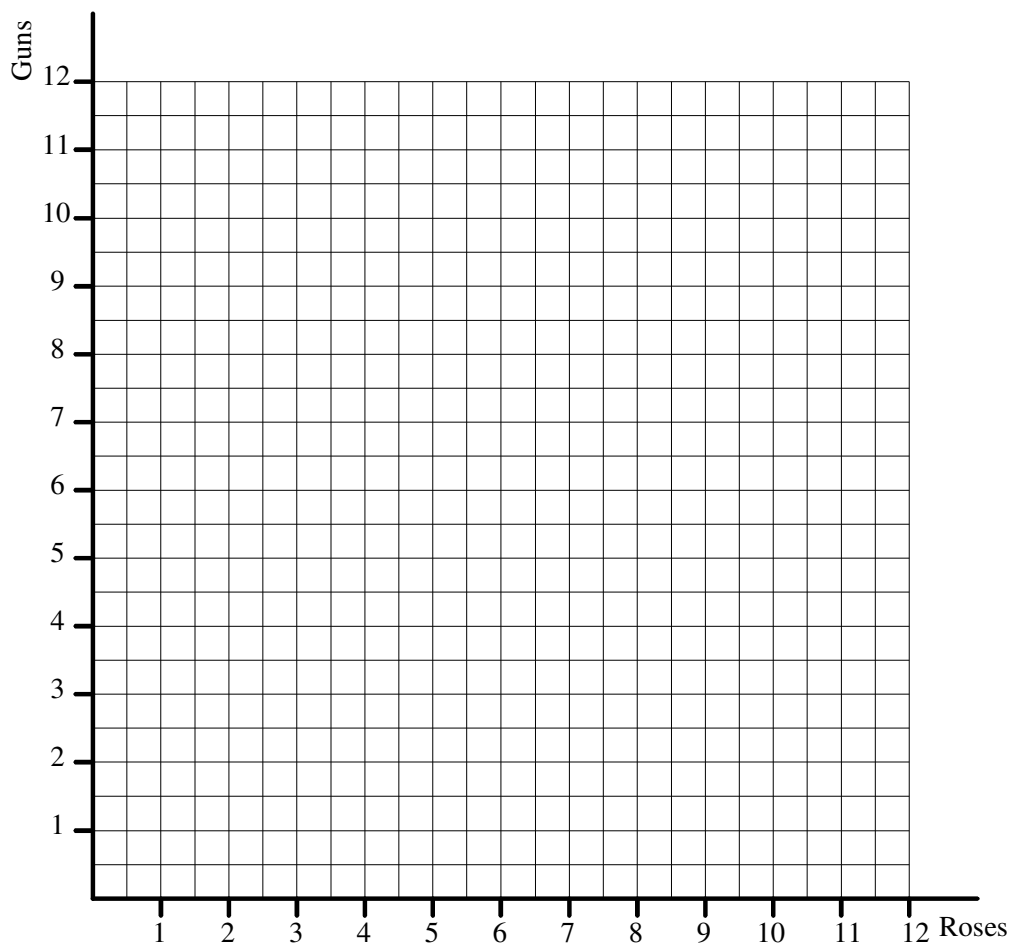
- e.) Indicate which areas of the graph correspond to
  - a. infeasible production points
  - b. production points where there is unemployment
  - c. efficient production points
- f. Suppose that the AUB economy is producing at point D. One day President Waterbury suggests that fewer resources be used to produce Frisbees and more for boomerangs. As a result, the AUB community moves to point C, which president Waterbury claims is more efficient? Why is point C more efficient?
- g. How would AUB's PPF be altered by an improvement in the technology of producing boomerangs?
- h. President Waterbury annexes a nearby college which has the same technology as AUB but only half the resources. This takeover creates what President Waterbury calls "Greater AUB." How does Greater AUB's PPF compare to the PPF of part a.) above?

## Problem 2: Production Possibility Frontier II

The economy of Beirut has the following resource endowment:

Labor            36 Workers  
Land             10 Square Kilometers  
Gun Factory    10 Factories

Only two goods are produced: Guns and Roses. It takes three workers,  $\frac{1}{2}$  square kilometer of land, and 1 gun factory to produce one gun. It takes six workers, 2 square kilometers of land and no gun factory to produce a bouquet of roses.



- Construct Beirut's PPF. Does the curve exhibit increasing opportunity cost?
- Which resource would Beirut need more of in order to produce 9 guns and 2 bouquets of roses?
- Which resource would Beirut need more of in order to produce 1 gun and 5 bouquets of roses?
- What conclusion can you draw if you observe that Beirut is producing 5 guns and 3 bouquets of roses?

### Problem 3: Absolute and Comparative Cost Advantage

Ernie and Bert are farmers, producing apples and oranges. Each works twelve hours a day. It takes Ernie 1 hour to produce a sack of apples and 1 hour to produce a sack of oranges. Bert is less efficient. It takes him 1.5 hours to produce a sack of apples and 3 hours to produce a sack of oranges. The following table summarizes this relationship. Fill out the rest of the table, where you are asked to determine each farmer's opportunity costs (OC) of producing a sack of apples and a sack of oranges and in which good each farmer has a comparative advantage?

	Ernie	Bert
1 Sack of Apples	1	1.5
1 Sack of Oranges	1	3

Opportunity costs of producing 1 sack of apples	A.	0.33 sacks of oranges	A.	0.33 sacks of oranges
	B.	1 sack of oranges	B.	0.5 sacks of oranges
	C.	1.5 sack of oranges	C.	0.67 sacks of oranges
	D.	4 sacks of oranges	D.	1 sack of oranges

Opportunity costs of producing 1 sack of oranges	A.	0.67 sacks of apples	A.	0.33 sacks of apples
	B.	1 sack of apples	B.	1 sack of apples
	C.	1.5 sacks of apples	C.	2 sacks of apples
	D.	8 sacks of apples	D.	3 sacks of apples

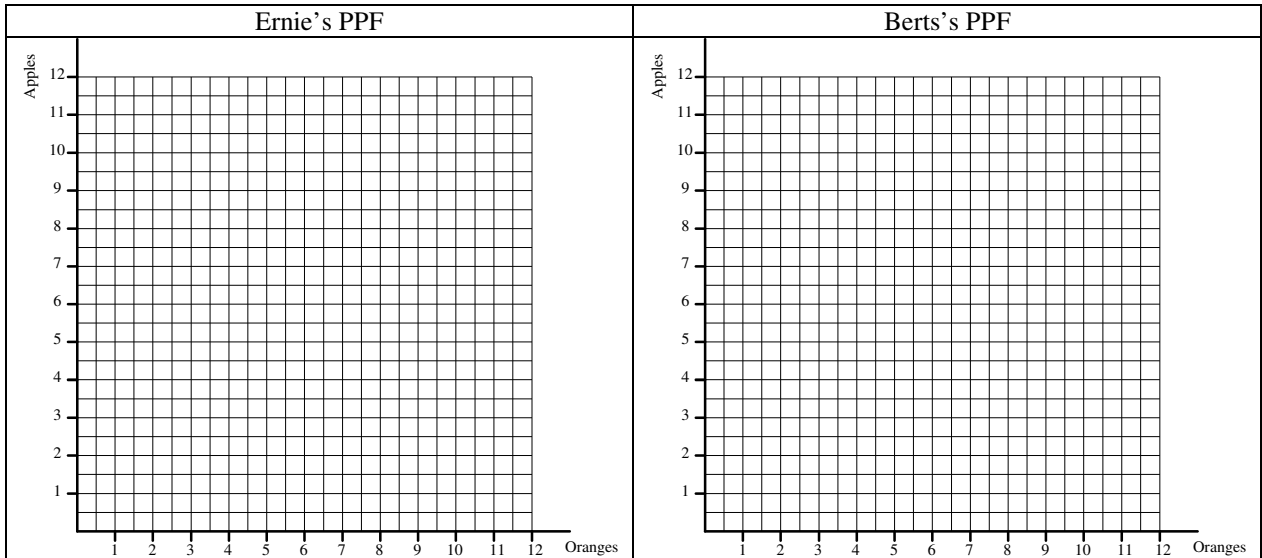
Absolute cost advantage in?	A.	Oranges	A.	Oranges
	B.	Apples	B.	Apples
	C.	Both	C.	Both
	D.	None	D.	None

Comparative cost advantage in?	A.	Oranges	A.	Oranges
	B.	Apples	B.	Apples
	C.	Both	C.	Both
	D.	None	D.	None

Increasing Opportunity Cost?	A.	Yes	A.	Yes
	B.	No	B.	No
	C.	Cannot be answered	C.	Cannot be answered

### Problem 3: Absolute and Comparative Cost Advantage (Continued)

Now draw Ernie and Bert's PPF.



Assume initially that Ernie and Bert do not trade with each other. The following table shows the profit maximizing combinations under autarky.

	Ernie	Bert
Sacks of Apples	4	2
Sacks of Oranges	8	3

Ernie's production combination is located

- A. Inside the production possibility boundaries
- B. On the production possibility boundaries
- C. Outside the production possibility boundaries
- D. Cannot be answered without additional information

Assuming that Ernie and Bert specialize on the production of the goods in which each has a comparative advantage, then

Total output of sacks of apples will be		Total outputs of sacks of oranges will be	
<input type="checkbox"/> A.	4	<input type="checkbox"/> A.	2
<input type="checkbox"/> B.	6	<input type="checkbox"/> B.	4
<input type="checkbox"/> C.	8	<input type="checkbox"/> C.	8
<input type="checkbox"/> D.	12	<input type="checkbox"/> D.	12

Under specialization and trade, how many units of what kind of good could Ernie and Bert consume in excess to their individual profit maximization combinations under autarky?

- A. 1 sack of apples
- B. 1 sack of oranges
- C. 1 sack of apples and 1 sack of oranges
- D. 2 sack of apples and 1 sack of oranges

## CHAPTER 3: DEMAND, SUPPLY AND MARKET EQUILIBRIUM

### Problem 1: Demand, Supply, and Price

How does each of the following events affect the market for chickens? For each, discuss which curve has shifted. Holding everything else constant, discuss also the resulting change in equilibrium price and quantity

- a. A severe winter reduces the cattle population.
- b. The price of poultry feed decreases.
- c. Chicken is found to be a good source of a newly discovered nutrient.
- d. A cheaper method is found for preventing chicken cannibalism.
- e. There is a rapid increase in the human population.
- f. There is a recession and consumers expect significant lower incomes.
- g. Betty Crocker markets a quicker, cheaper stuffing mix.



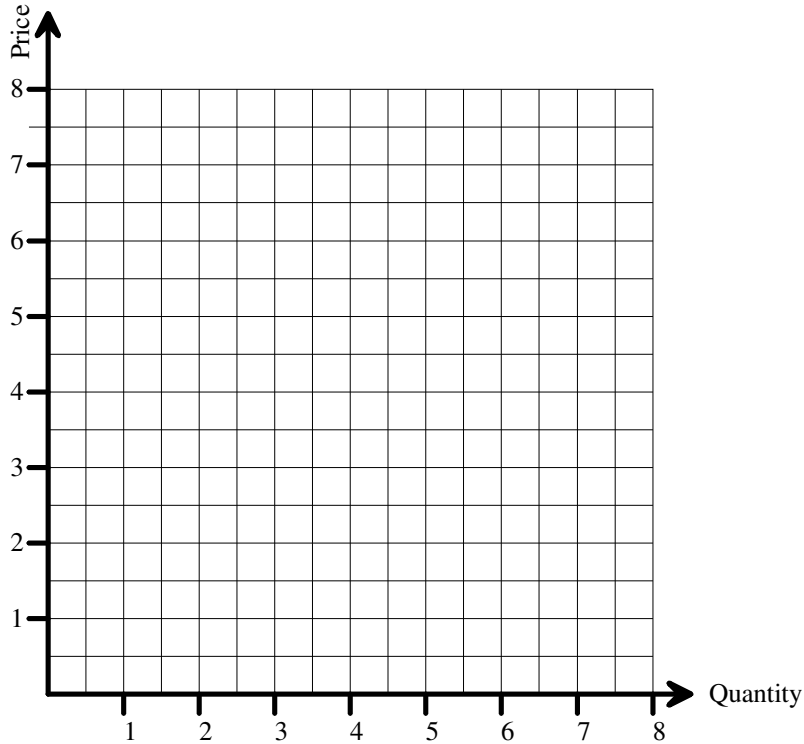
**Problem 2: Demand, Supply, and Price**

Given is the following (inverse) demand and supply curve:

Demand:  $P = 8 - Q$

Supply:  $P = 2 + Q$

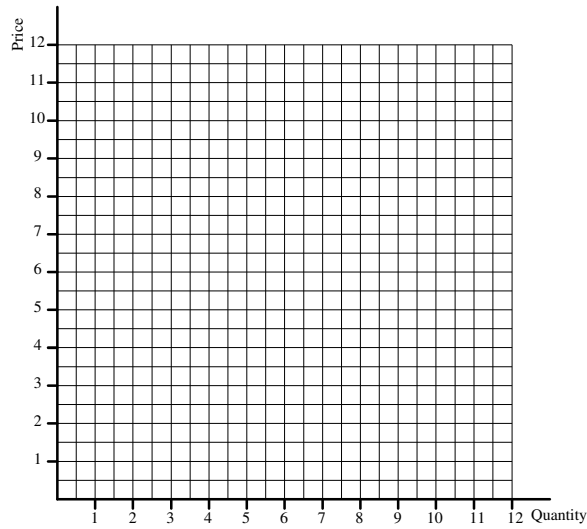
Draw the demand and supply into the following diagram:



Fill out the following table:

Price	Quantity Demanded	Quantity Supplied	Excess Supply	Excess Demand
7				
6				
5				
4				
3				

### Problem 3: Demand, Supply, and Price



a.) Suppose the quantity demanded function is

$$Q_D = 6 \quad \underline{\hspace{1cm}} \quad 2 \cdot P_B \quad \underline{\hspace{1cm}} \quad 2 \cdot P_E \quad \underline{\hspace{1cm}} \quad 2 \cdot P_C \quad \underline{\hspace{1cm}} \quad 0.004 \cdot Y$$

Where  $Q_D$  is the quantity of light bulbs demanded,  
 $P_B$  is the price of light bulbs  
 $P_E$  is the price of electricity  
 $P_C$  is the price of candles, and  
 $Y$  is income

The signs [Plus (+) or minus (-)] have not been provided in the quantity demanded function. Fill in the signs such that they are consistent with economic theory. Assume that light bulbs are normal goods.

- i.) Initially,  $P_E = 2$ ,  $P_C = 1$ , and  $Y = 1,000$ . What is the demand function? Graph it.
- ii.) Suppose income doubles. What is the demand function now? Graph it in the same diagram.

b.) Suppose the quantity supplied function is

$$Q_S = \underline{\hspace{1cm}} \quad 1 \cdot P_B \quad \underline{\hspace{1cm}} \quad 0.1 \cdot W \quad \underline{\hspace{1cm}} \quad 0.5 \cdot P_T$$

Where  $Q_S$  is the quantity of light bulbs supplied,  
 $P_B$  is the price of light bulbs  
 $W$  is the wage rate of workers manufacturing light bulbs, and  
 $P_T$  is the price of tungsten

The signs [Plus (+) or minus (-)] have not been provided in the quantity supplied function. Fill in the signs such that they are consistent with economic theory. Find the quantity supplied function and graph it in each of the following cases:

- i.)  $W = 5$  and  $P_T = 1$
- ii.)  $W = 10$  and  $P_T = 4$ .

c.) Find the equilibrium price and quantity in each of the following cases. Compare the equilibrium in ii.) with i.).

- i.) a(i) and b(i)
- ii.) a(ii) and b(ii)

d.) Determine graphically the intersection of

- i.) a(i) and b(ii)
- ii.) b(i) and a(ii)

#### Problem 4: Demand, Supply, and Price

1. Given is the following demand curve (D):

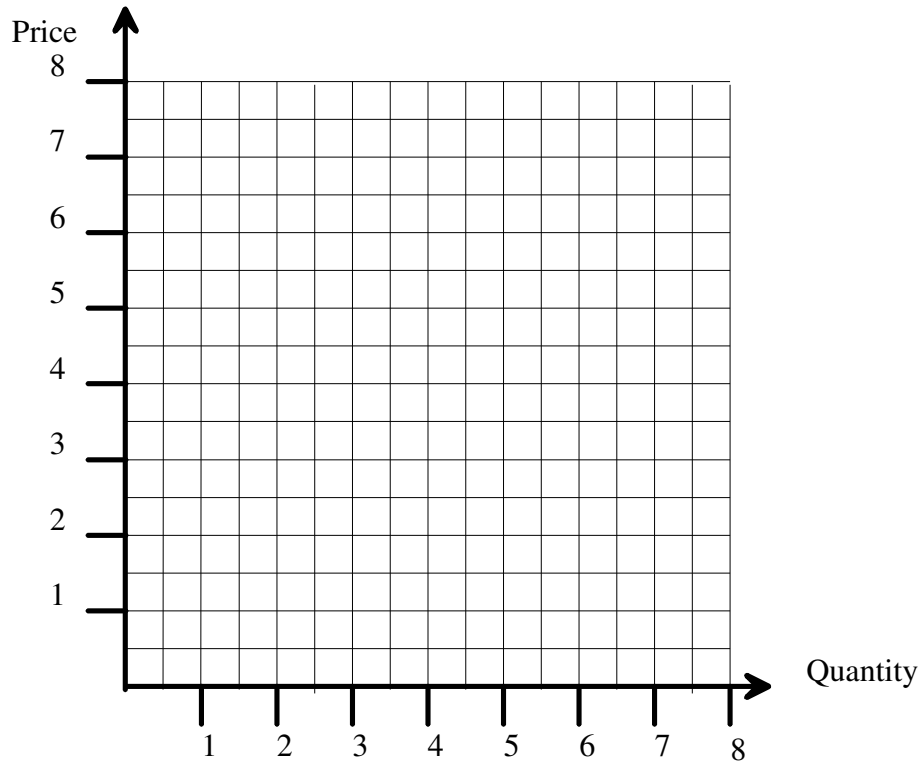
$$D: \quad P = 8 - Q$$

Assume two different supply curves,  $S_1$  and  $S_2$ :

$$S_1: \quad P = Q$$

$$S_2: \quad P = 4$$

Denote the intersection between demand and the two supply curves as point A.  
Now assume that government introduces a sales tax (T) of  $T = 2$ . Discuss the effects on market price, new quantity actually bought, and welfare in dependence of the different supply curves. Using the following diagram may help.



**Problem 4: Demand, Supply, and Price (Continued)**

2. Given is the following supply curve (S):

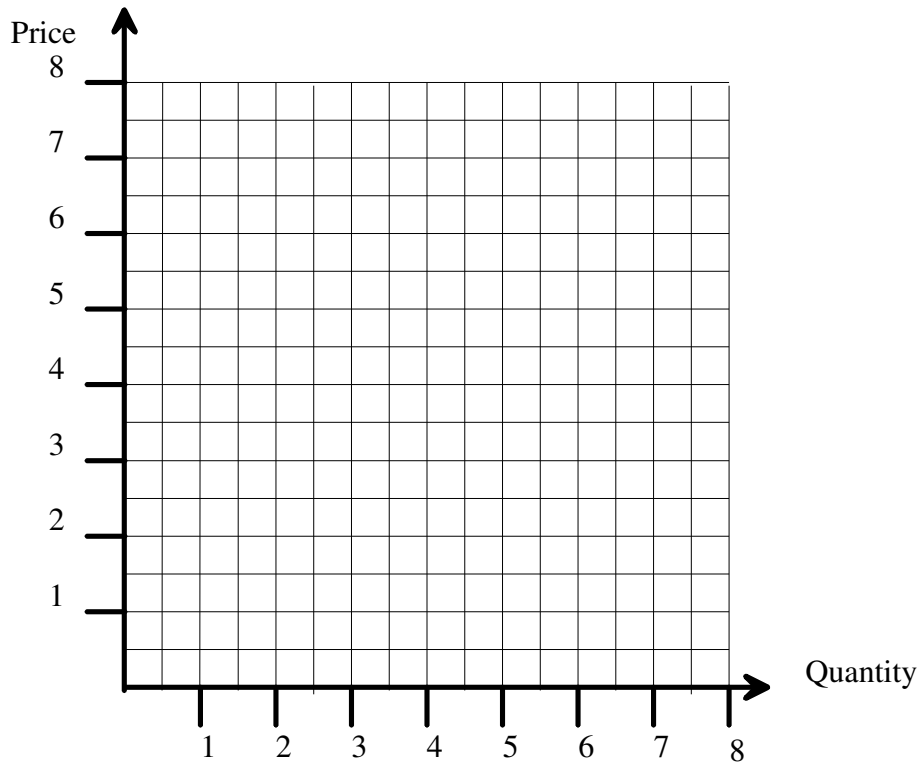
$$S: \quad P = 1 + Q$$

Assume two different demand curves,  $D_1$  and  $D_2$ :

$$D_1: \quad Q = 4$$

$$S_2: \quad P = 7 - Q$$

Denote the intersection between supply and the two demand curves as point A. Now assume that government introduces a sales tax (T) of  $T = 2$ . Discuss the effects on market price, quantity actually bought, and welfare in dependence of the different demand curves. Using the following diagram may help.



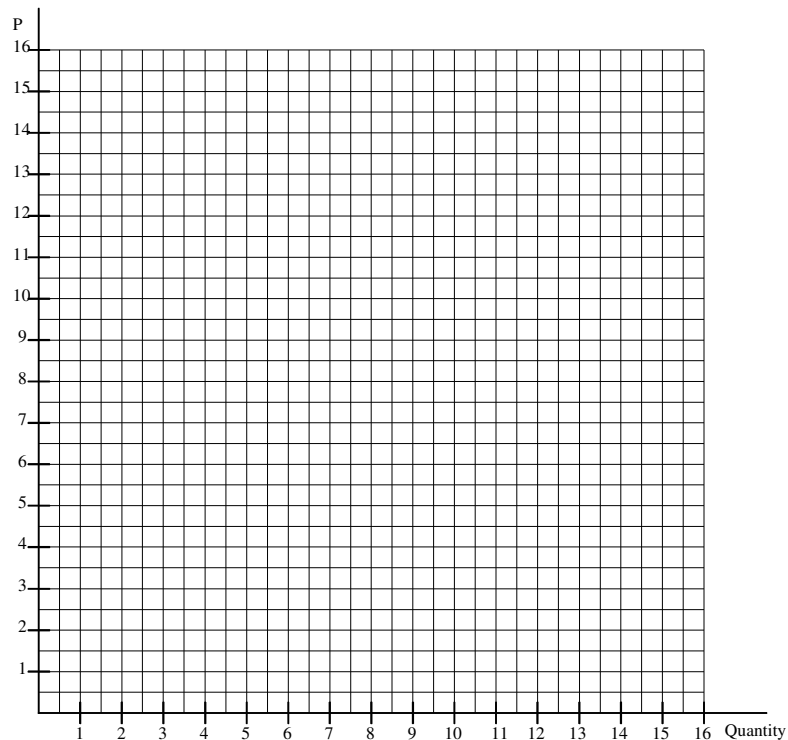
### Problem 5: Demand, Supply, and Price

Consider the following demand and supply equations for bread in Lebanon.  $Q_D$  is quantity of bread demanded by consumers (in millions of kilos per month),  $Q_S$  is quantity of bread supplied (in millions of kilos per month),  $P_B$  is the market price for kilo of bread (in 1,000s of Lebanese Liras), and  $I$  is monthly income (in 1,000s of Lebanese Liras).

$$Q_D = 10 - 1 \cdot P_B + 1/300 \cdot I$$

$$Q_S = 2 \cdot P_B - 6$$

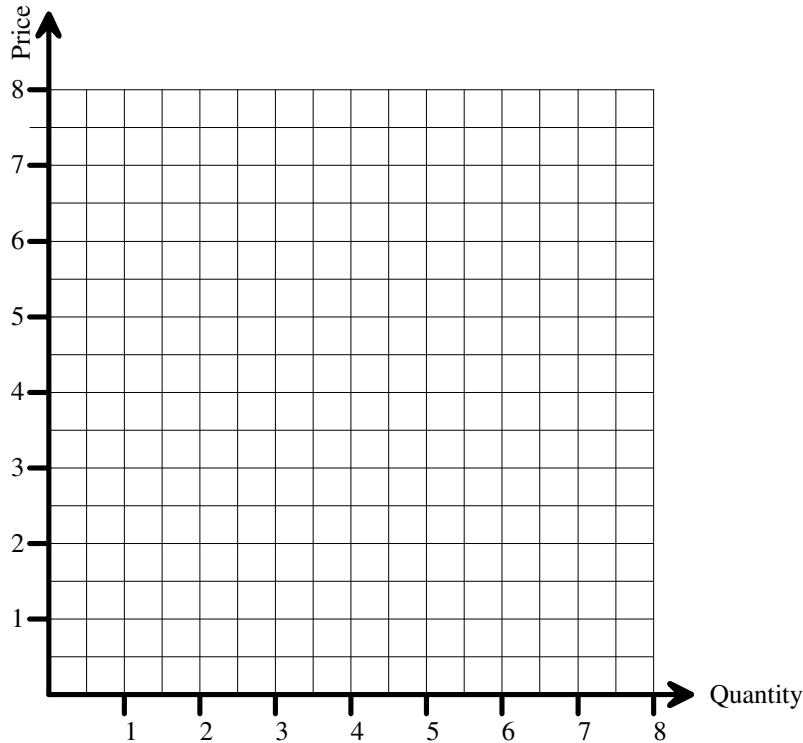
- a. If average income per month is  $I = 600$ , what is the equilibrium quantity and price? Illustrate this on the graph below. Please conduct a welfare analysis of the market.



- b. The government finds that the price of bread is too high and decides to impose a price ceiling of LL 5,000 per kilo. What are the new quantities demanded and supplied in the market? What is the amount of the surplus or shortage? What is the quantity of bread exchanged in the market? How does welfare change?
- c. After imposing the price ceiling, the government conducts a survey and finds that most consumers who want bread are able to obtain the quantity they want. Suggest possible explanations for this finding. Think outside the box.
- d. The Lebanese government decides to abandon price controls in favor of a per unit subsidy ( $S$ ) of  $S = 1,500$  per kilo of bread produced. Illustrate graphically and compare the effects of this policy from a welfare perspective to the situation in a.). How much does the subsidy program cost government?
- e. Going back to question a., assume the Lebanese government sells one of the country's mountains and islands and passes on the revenues as a tax break to the Lebanese people, so that disposable income goes up from  $I = 600$  to  $I_{New} = 1,500$ . Holding everything else constant, how does this change equilibrium quantity, price, and welfare? Illustrate your results again graphically.

## Problem 6: Demand, Supply, and Price

Draw all relevant graphs into the following diagram.



- Assume the initial demand (D1) and supply (S1) for coffee is  $D1: P = 6 - 0.5Q$  and  $S1: P = Q$ , respectively. What are equilibrium price and quantity? Denote this equilibrium "Point A."
- As a result of a tropical storm in Banana Republic, which destroyed a substantial amount of the coffee plantation, the new supply curve (S2) is  $S2: P = 3 + Q$ . What are the new equilibrium price and quantity? Denote this equilibrium "Point B."
- Now assume that in addition to the reduction of supply, people anticipate a shortage of coffee and begin hoarding coffee. The new demand curve (D2) is  $D2: P = 7.5 - 0.5Q$ . What are the new equilibrium price and quantity? Denote this equilibrium "Point C."
- Identify all shifts and movements of demand and supply when moving from "A" over "B" to "C."
- Comparing "Point A" and "Point C," why did the decrease in supply and increase in demand not cancel out in terms of quantity demanded and quantity supplied?
- Calculate the point elasticity of demand and supply in point A, B, and C.
- Since the price of coffee has increased dramatically, the government of Banana Republic decides to impose a maximum price on coffee of  $P_{\text{Max}} = 4$ . Discuss the results.
- As a result of the maximum price, many have lost their job. More and more go on the streets and demonstrate for a policy change. Eventually, a new government takes over and promises to create new jobs. As a first step, the new government abandons the price ceiling on coffee and replaces it by a minimum price of  $P_{\text{Min}} = 7$  so that it "pays again" to produce coffee and to hire people. How do you evaluate this new policy?

**Problem 7: Demand, Supply, and Price**

Given is the following import demand curve (D):

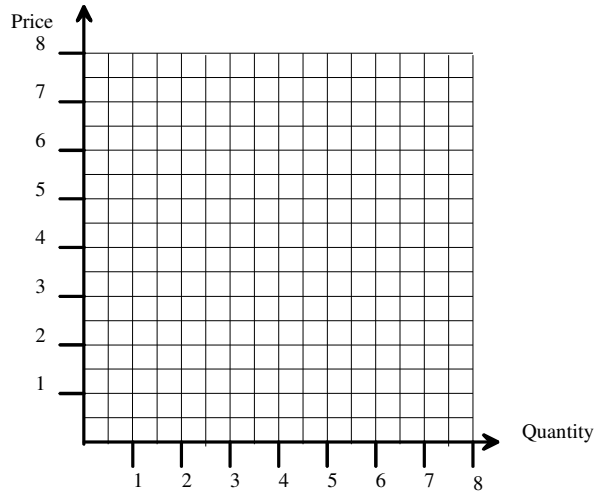
D:  $P = 8 - Q$

Assume three different import supply curves,  $S_1$ ,  $S_2$ , and  $S_3$ .

$S_1$ :  $P = 4$

$S_2$ :  $P = Q$

$S_3$ :  $Q = 4$



1. What are the quantities imported given  $S_1$ ,  $S_2$ , and  $S_3$ ?
2. What are the market prices given  $S_1$ ,  $S_2$ , and  $S_3$ ?
3. Assume government introduces an import tariff (T) of  $T=2$ . What are the new import-supply curves given  $S_1$ ,  $S_2$ , and  $S_3$ ?
4. What are the new quantities imported?
5. What are the new market prices?
6. What are total tariff revenues?
7. Which percentage of the tariff is passed on to the consumers?

		$S_1$	$S_2$	$S_3$
1.	Quantity imported			
2.	Market price			
3.	New supply curves			
4.	New quantities imported			
5.	New market prices			
6.	Tariff revenues			
7.	Percentage passed on to consumers			

### Problem 8: Demand, Supply, and Price

Assume the following demand and supply curves for grain in the European Union (EU). The supply in the European Union is made up of domestic supply by European producers ( $S_{EU}$ ) and import supply by World producers ( $S_{World}$ ).

$$D_{EU}: P = 8 - Q$$

$$S_{EU}: P = 2 + Q$$

$$S_{World}: P = 3$$

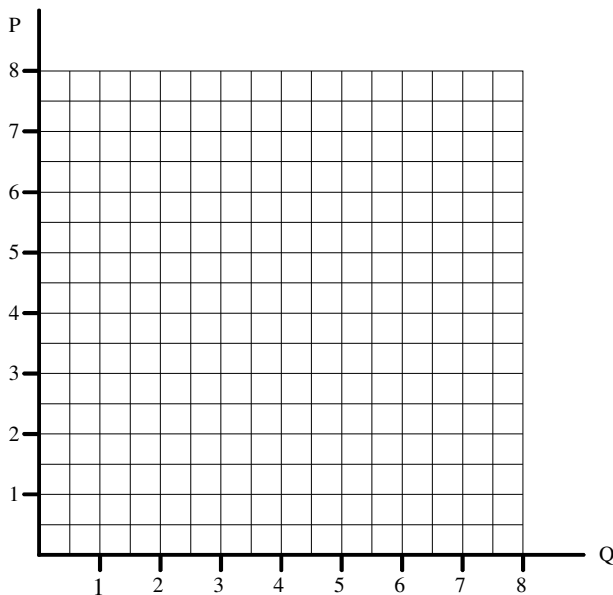
1. What is the equilibrium price and quantity? How much is domestically produced and how much is imported?
2. Since European Farmers can barely compete with World imports, European farmers lobby successfully for an import tariff of  $T = 4$  and a price floor for grain of  $P_{Floor} = 6$ . What is the new equilibrium price and quantity? How much is domestically produced and how much is imported?
3. The EU is increasingly confronted with non-sellable mountains of grain. So the EU commission for smart economic development policy decides to ship European excess supply to Africa for free. Africa's demand and supply curve for grain are:

$$D_{Afr.}: P = 6 - Q$$

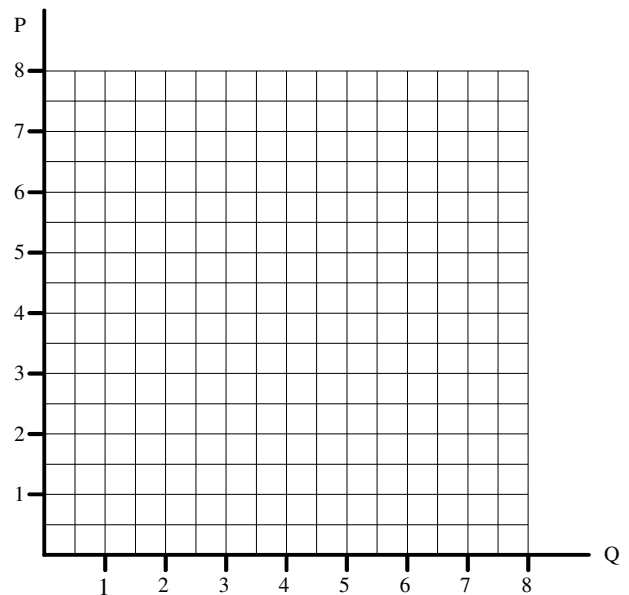
$$S_{Afr.}: P = 2 + Q$$

- a. What is the equilibrium price and quantity in Africa?
- b. What is Africa's new supply curve after the EU sent its benevolent gift?
- c. How does the grain gift benefit African grain output and African grain prices?
- d. Who wins and who loses from the EU's policy in Europe and in Africa?

EU Market



Africa's Market





## CHAPTER 4: DEMAND AND SUPPLY APPLICATIONS AND ELASTICITY

### Problem 1: Elasticity

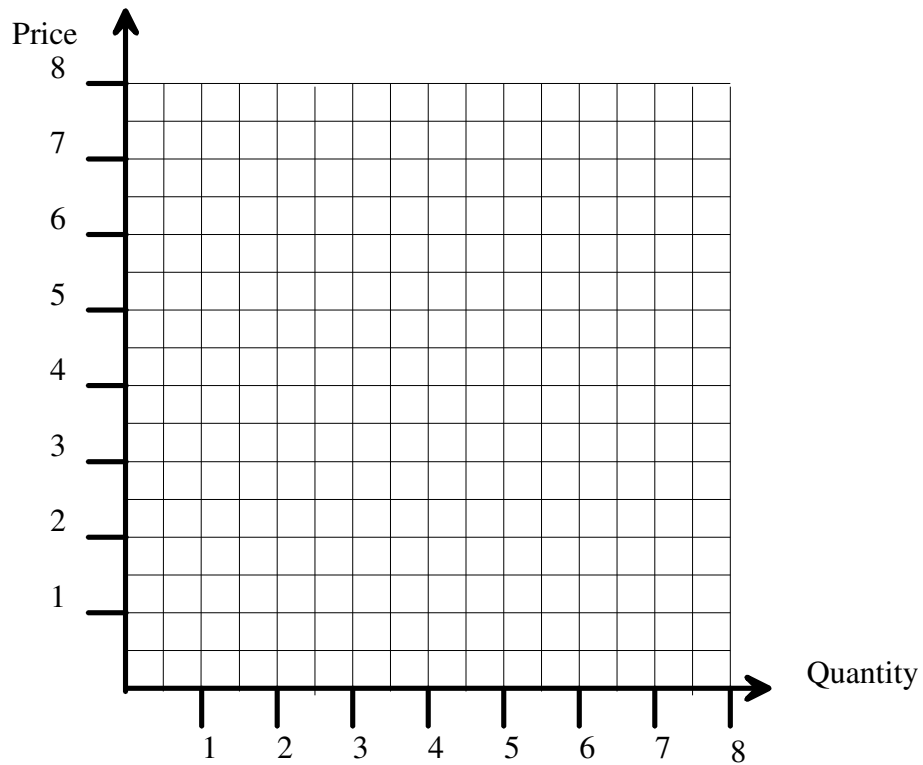
1. Draw the following three inverse demand curves into the diagram below:

$$D1: P = 8 - Q$$

$$D2: P = 8 - 2Q$$

$$D3: P = 8 - 4Q$$

Calculate for all three demand curves the point elasticity of demand for  $P = 4$ .

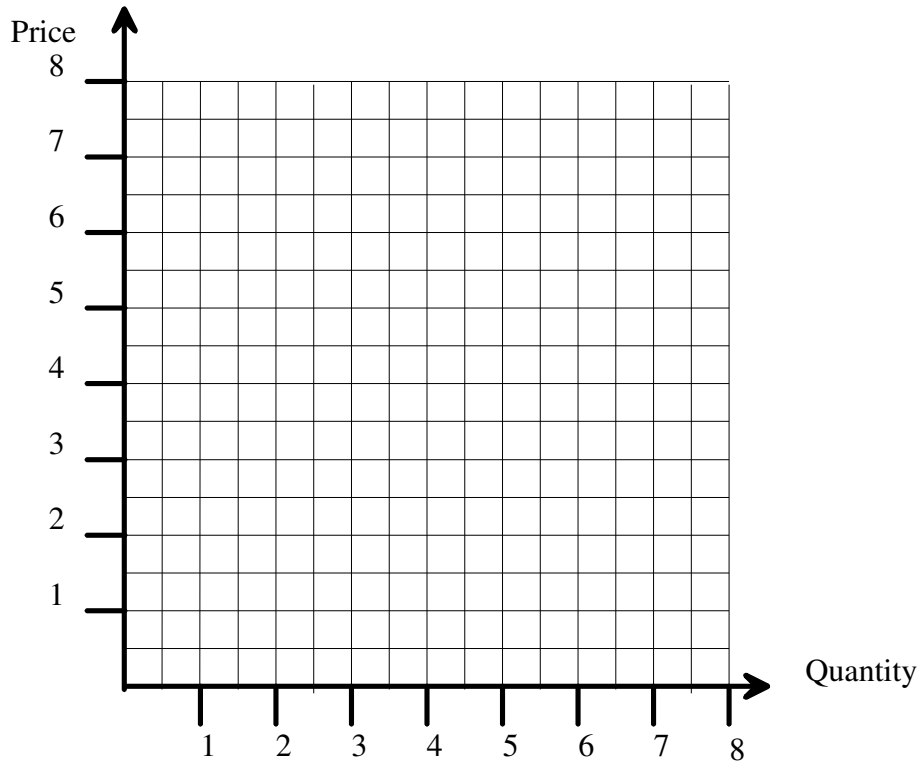


**Problem 1: Elasticity (Continued)**

2. Draw the following two inverse demand curves into the diagram below:

D1:  $P = 6 - Q$

D2:  $P = 5 - 0.5 Q$

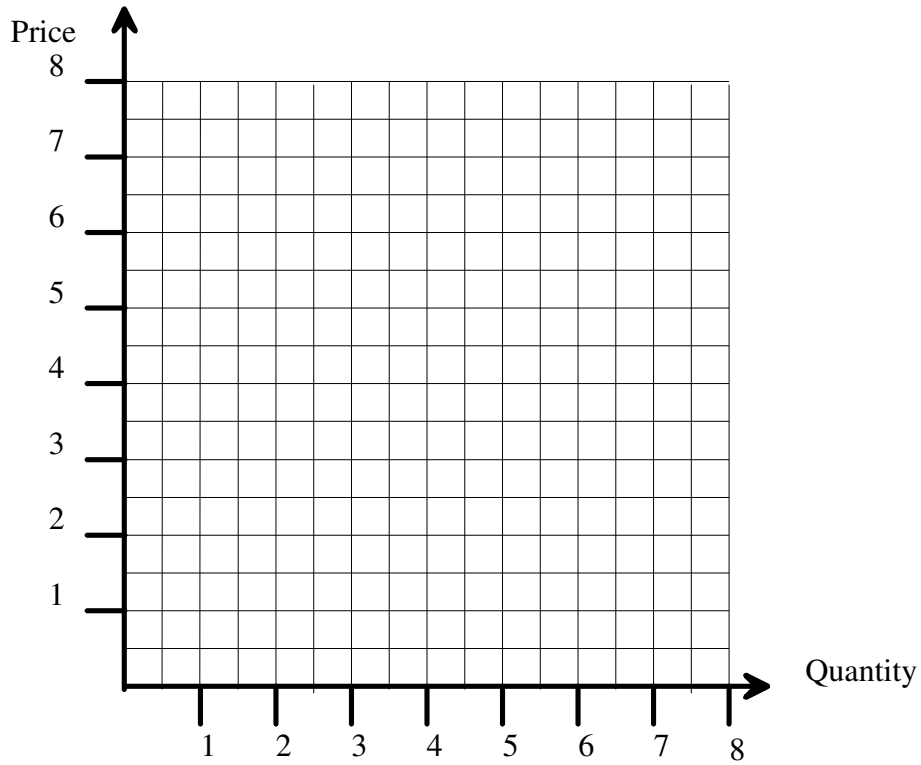


Calculate for all two demand curves the point elasticity of demand at  $P = 4$ .

**Problem 1: Elasticity (Continued)**

3. Draw the following two demand curves into the diagram below:

D1:  $P = 4 - Q$   
D2:  $P = 8 - 2Q$



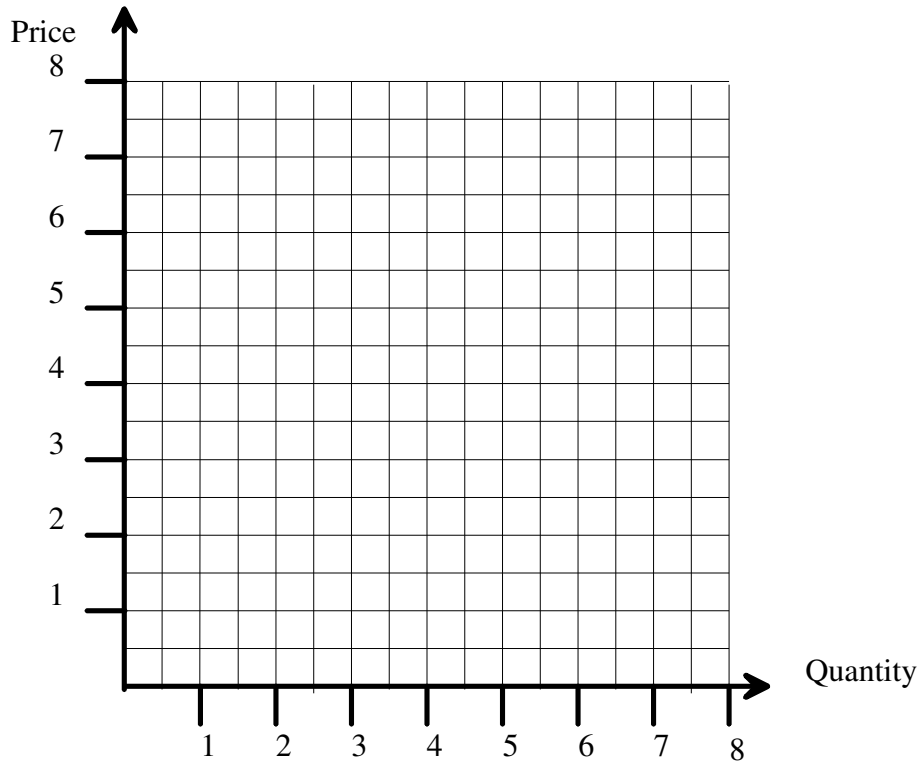
Calculate for all two demand curves the point elasticity of demand for  $Q = 2$ .

**Problem 1: Elasticity (Continued)**

4. Draw the following two demand curves into the diagram below:

D1:  $P = 4 - Q$

D2:  $P = 8 - Q$



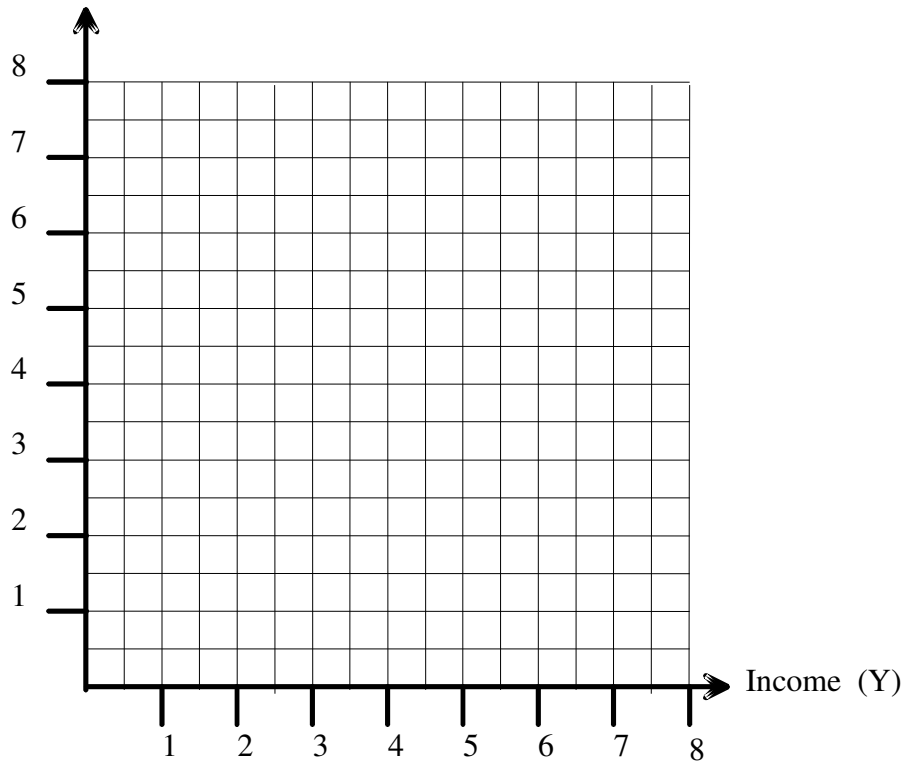
Calculate for all two demand curves the point elasticity of demand for  $Q = 2$  and then for  $P = 2$ .

## Problem 2: Income Elasticity of Demand

	Point A	Point B	Point C	Point D
Income	1	3	5	7
Demand	1	3	3	1

Draw Point A, B, C, and D in the following diagram and connect them by straight lines assuming that those lines represent demand functions in dependence of income.

Demand (Q)



1. Find the demand function (D) of income for  $D(A \rightarrow B)$ ,  $D(B \rightarrow C)$ , and  $D(C \rightarrow D)$ .
2. What's the income elasticity of demand at the following levels of income (Y):  $Y = 2$ ,  $Y = 4$ , and  $Y = 6$ ?

### Problem 3: The Laffer Curve

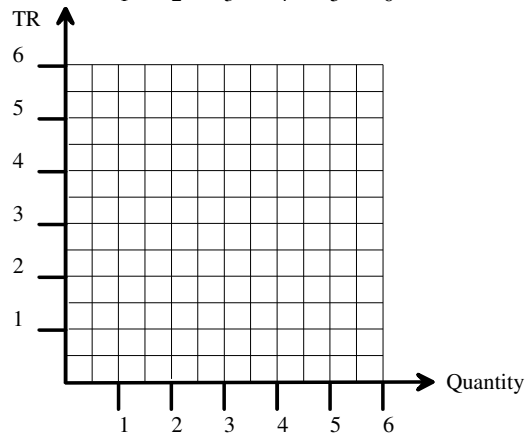
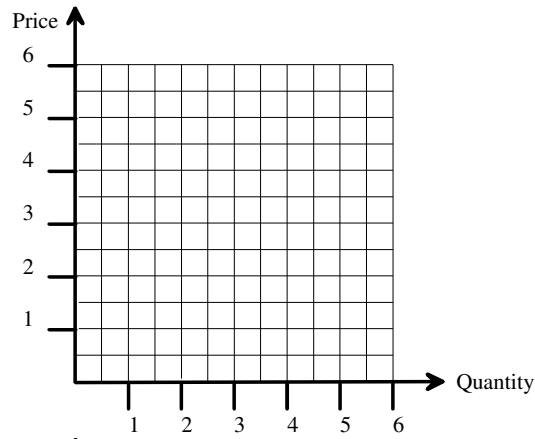
The Laffer curve depicts the relationship between taxes and tax revenues as an inverse U. Many politicians all over the world have already made some rather frustrating acquaintance with Mr. Laffer's curve. For example, many governments raised taxes on cigarettes hoping to fill their budget deficits only to find out that tax revenues eventually decreased. Assume that the demand curve for cigarettes in dependence of the tax rate (T) is

Demand:  $T = 5 - Q$

Complete the following table and calculate the different tax revenues (TR) for the different Ts as well as the corresponding point elasticities.

Ts	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
TR											
$\epsilon$											

Assume you are a policy consultant to a government, which considers increasing the tax rate on cigarettes from  $T = 2$  to  $T = 3$ . Would you support or oppose the government's plans? Discuss your result.



## CHAPTER 5: HOUSEHOLD BEHAVIOR AND CONSUMER CHOICE

### Problem 1: Total Utility vs. Marginal Utility and Demand Curve

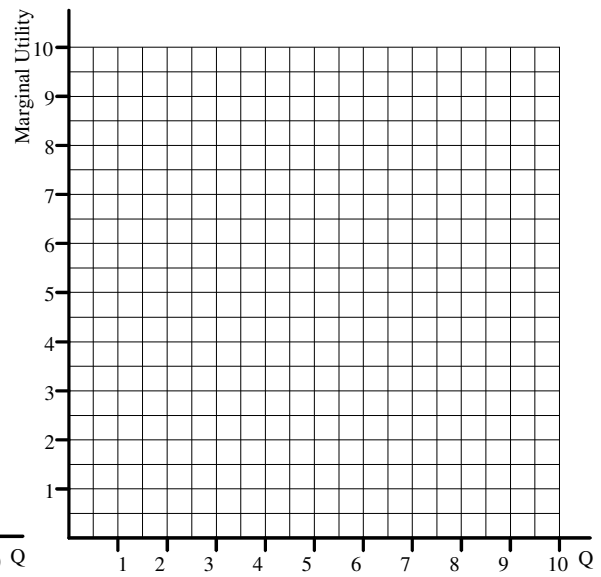
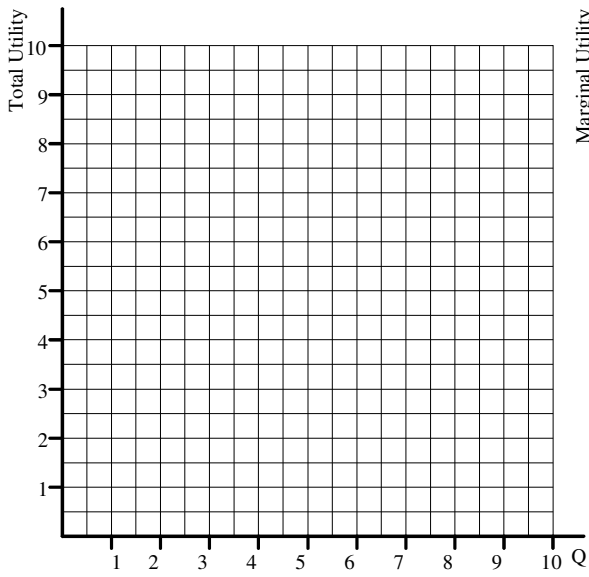
As school increasingly stresses you out, you decide to take a couple of days off and to head for the beach for a real sun and fun deal. Since you want to look great at the beach and at the night clubs that you plan to visit extensively, you decide to buy some new outfits for the beach (B) and some elegant clothes (E) for the nightlife.

Qty.	Beach Wear (B)			Elegant Wear (E)		
	Total Utility (B)	Marginal Utility (B)	$\frac{MU(B)}{P_B}$	Total Utility (E)	Marginal Utility (E)	$\frac{MU(E)}{P_E}$
1	250			350		
2	450			550		
3	600			700		
4	700			800		
5	775			875		
6	800			900		

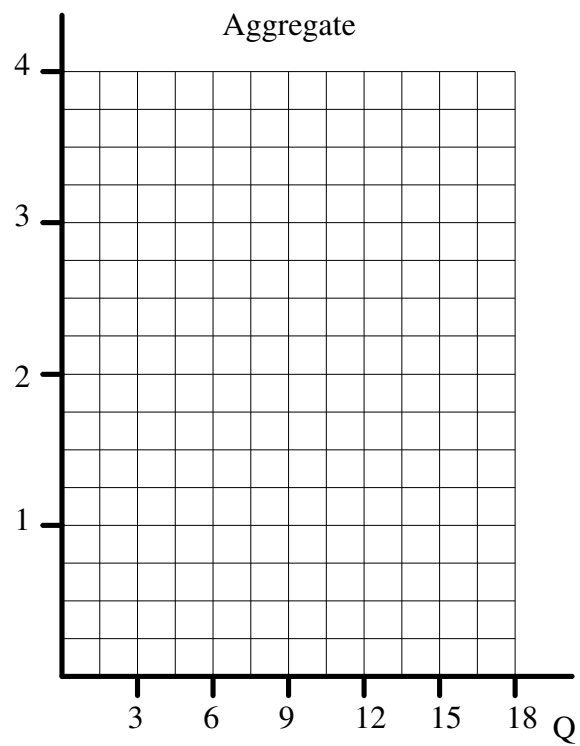
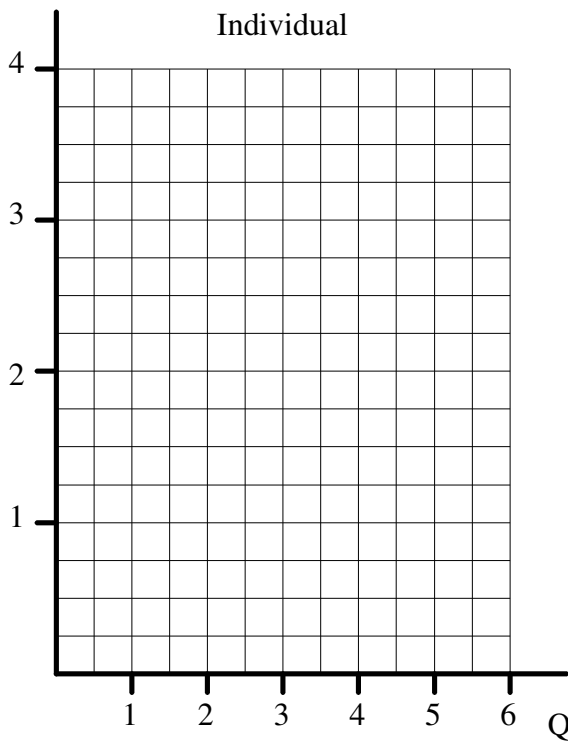
1. Draw the total and marginal utility functions for B and E.
2. If you have a budget of USD 160 and an item of each beach and elegant wear costs USD 20, how many items of beach wear and elegant wear will you buy? Why would you not buy five items of elegant wear and three items of beach wear? How big is your consumer surplus for beach and elegant wear, respectively?
3. If you have a budget of USD 160 and an item of beach wear costs USD 20 and an item of elegant wear costs USD 40, how many items of beach wear and how many items of elegant wear would you buy? Why would you not buy three items of elegant wear and two items of beach wear? How big is your consumer surplus for beach and elegant wear, respectively?
4. Locate the price-demand combination for elegant wear in a diagram. Estimate the shape of the demand curve for elegant wear for all prices.
5. Now assume that you and two of your best friends, who have exactly the same budget and preferences like you, join you to the beach. Locate the combined price-demand combinations of you three for elegant wear in a diagram. Estimate the shape of the aggregate demand curve for elegant wear for all prices. Sketch the area that represents consumer surplus.

**Problem 1: Total Utility versus Marginal Utility and Demand Curve (Contd.)**

**to Q1:**



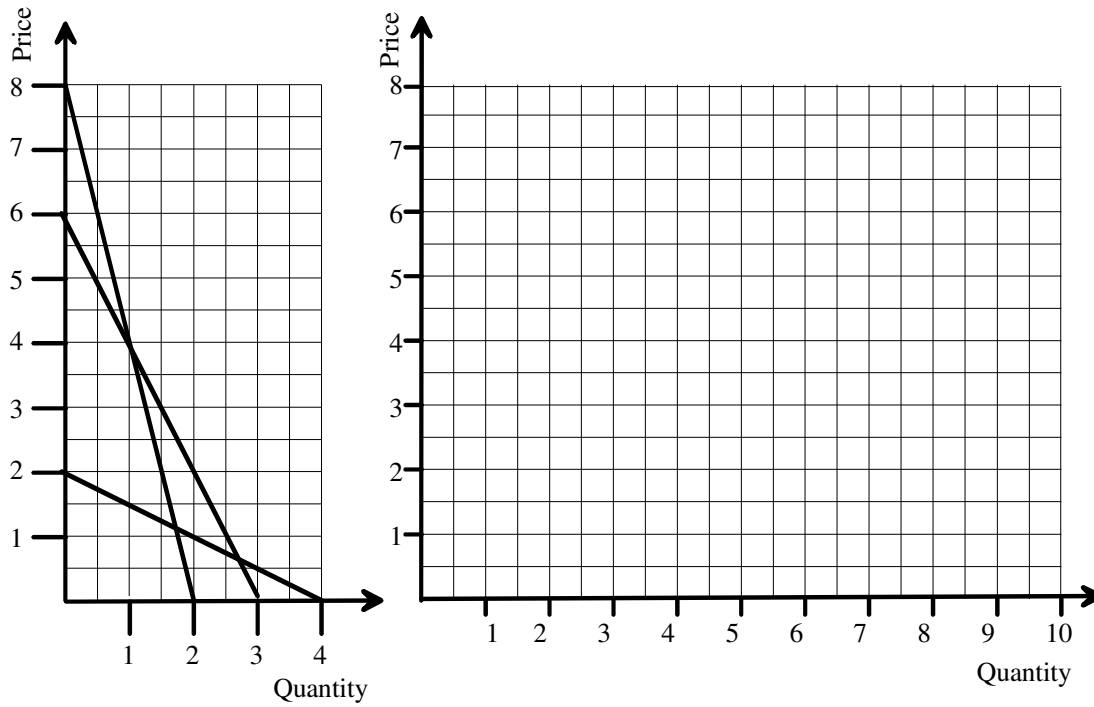
**to Q4 and Q5:**



The numbers on the y-Axis are in 100s



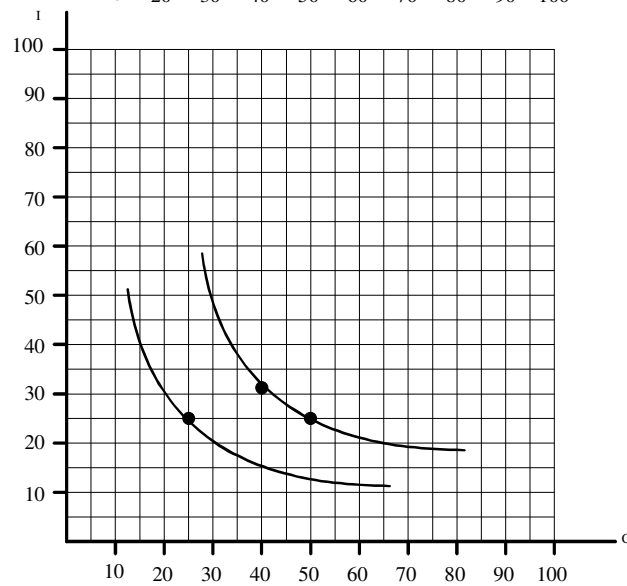
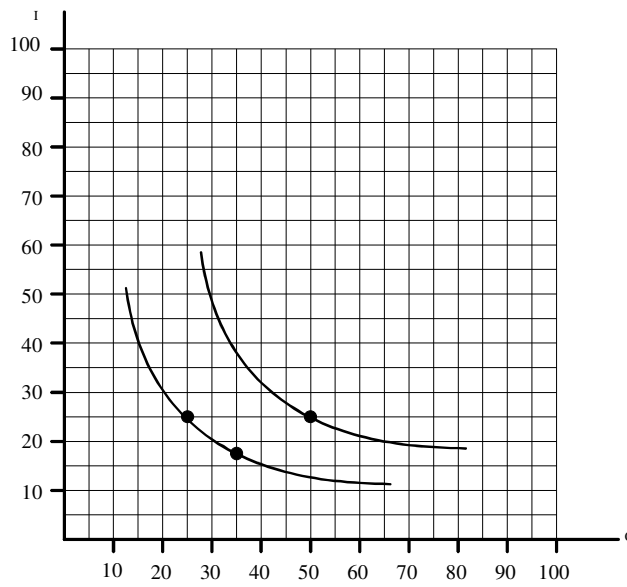
## Problem 2: Aggregate Demand



Form with the three individual demand curves from the left panel the aggregate demand curve in the right panel.

### Problem 3: Income and Substitution Effect

- a.) Assume you have a budget (B) of  $B = 100$  that you spend on chocolate bars (C) and ice cream (I). Initially, the prices for chocolate bars and ice cream are  $P_C = 2$  and  $P_I = 2$ . Draw the budget line and determine the consumption plan. Now assume that – holding everything else constant - the price for chocolate bars falls to  $P_C^{New} = 1$ . Draw the new budget line, and determine the new optimum consumption plan, as well as the income and substitution effect.
- b.) Now repeat the same exercise, assuming that the initial prices were  $P_I = 2$  and  $P_C = 1$ , respectively, and  $P_C$  increased to  $P_C^{New} = 2$ .

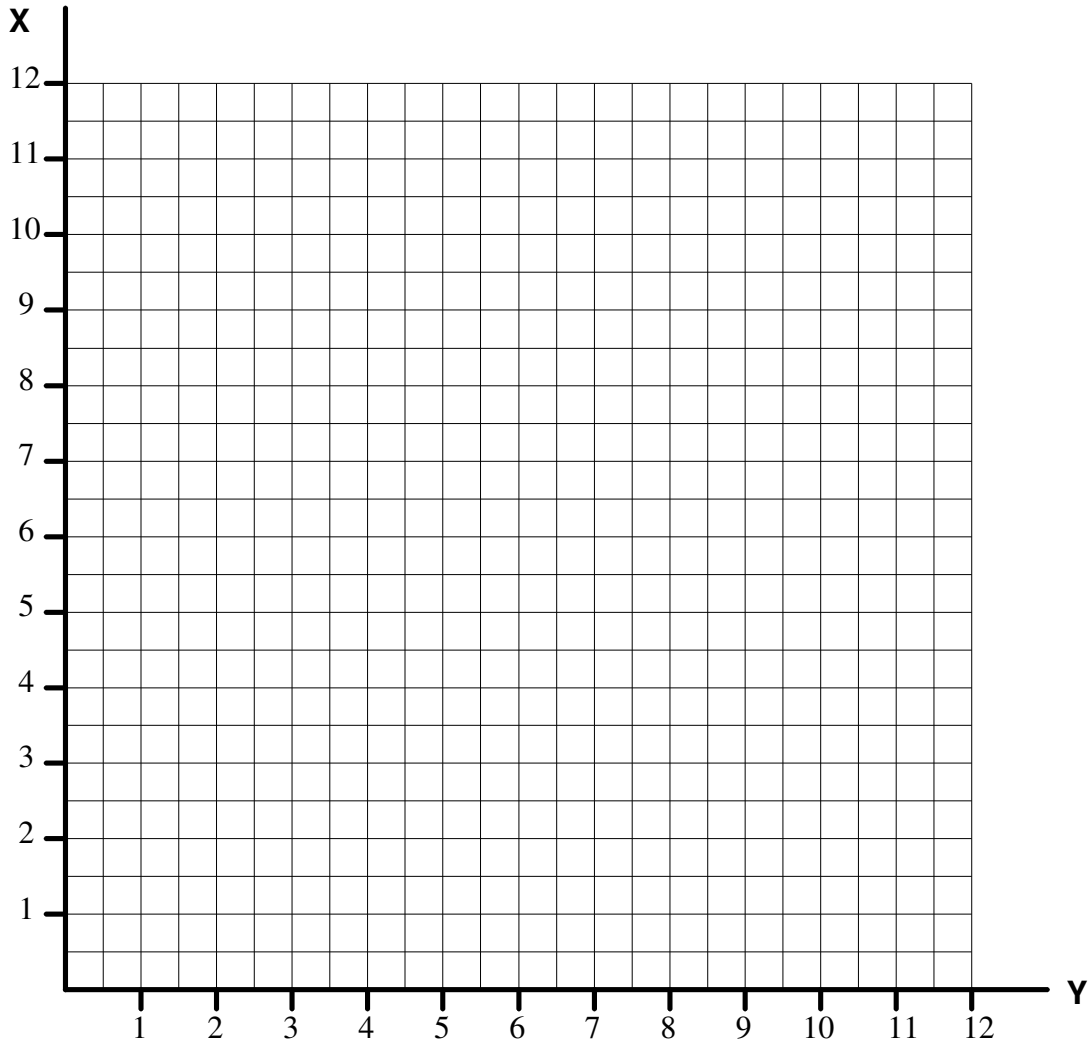


### Problem 4: Income and Substitution Effect

Given is the utility function  $U = X \cdot Y^2$ .

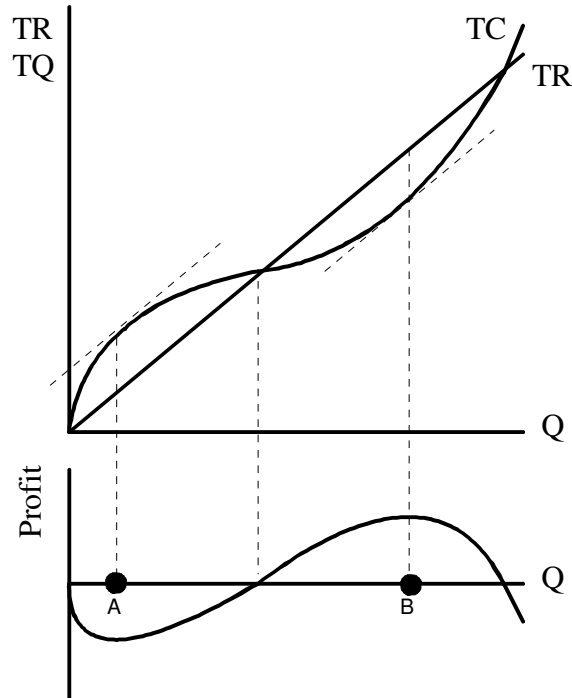
Your budget (B) is B=\$6. The prices for x and y are  $p_x=1$  and  $p_y=2$ , respectively.

- Draw the budget line into the diagram below.
- How many x and y do you buy in order to maximize your utility? How big is your total utility? Draw the indifference curve into the diagram below.
- Now assume that the price for y falls from  $p_y = 2$  to  $p_y = 1$ . Draw the new budget line into the diagram below.
- How many x and y do you buy now in order to maximize your utility? How big is your new total utility? Draw the new indifference curve into the diagram below.
- Estimate the income and substitution effect graphically?
- Difficult: Determine the income and substitution effect mathematically. Good Luck!



**CHAPTERS 6/7: THE PRODUCTION PROCESS: THE BEHAVIOR OF PROFIT  
MAXIMIZING FIRMS/SHORT RUN COSTS AND OUTPUT DECISIONS**

**Problem 1: Profit Maximization**

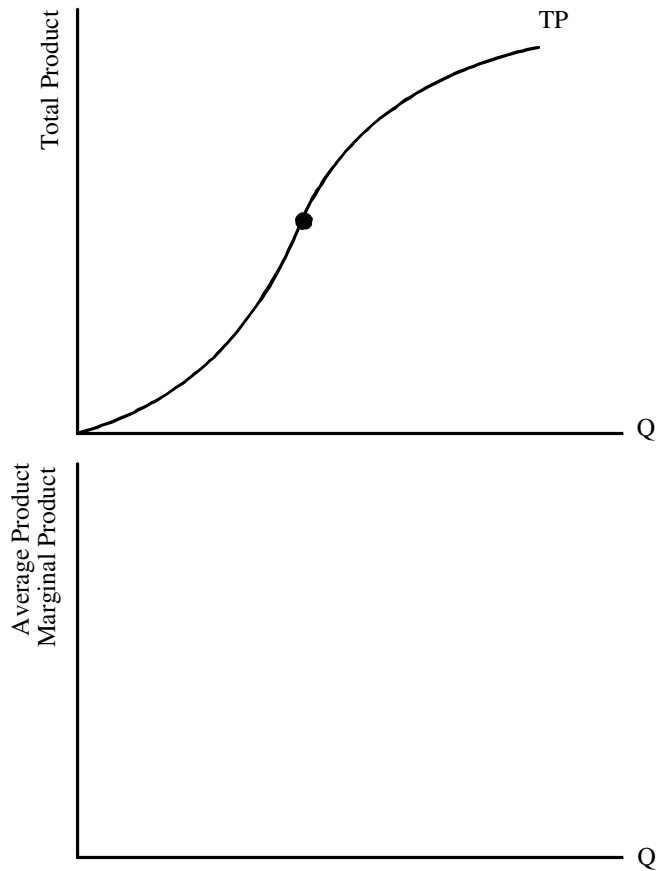


The total cost function is:  $TC = 10 + 5q - 3q^2 + 1/3q^3$   
 The total revenue function is:  $TR = 2.25q$

Determine the quantities associated with point A, E and F as well as the associated profits (Round to first decimal).

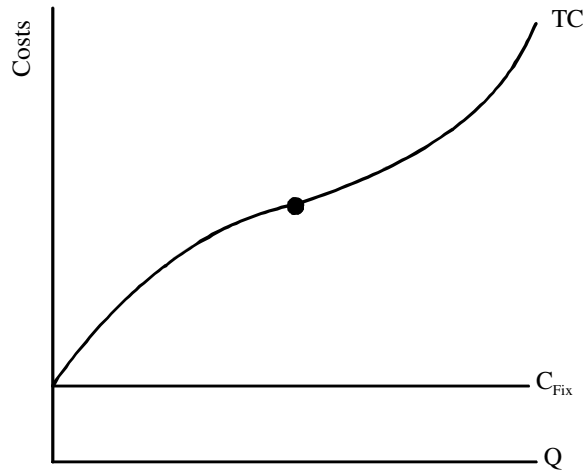
**Problem 2: Total Product, Average Product, Marginal Product**

Given is the following total product curve. Derive the marginal and average product curve graphically.



**Problem 3: Total Costs, Average Total Costs, Average Variable Cost, Marginal Cost**

Given is the following total cost curve. Derive the marginal, total average, and variable average cost curve graphically.



#### Problem 4: Output Decisions in the Short-Run and Market Entry

Assume a market with two firms that compete perfectly. The total cost function of the typical firm is

$$TC = 2Q + Q^2 + 1$$

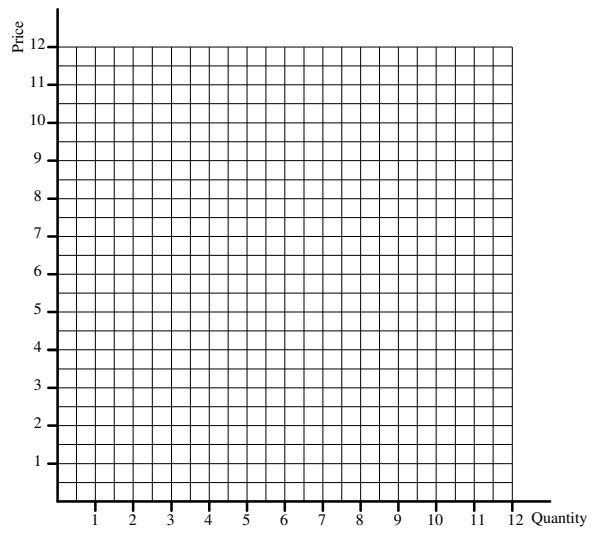
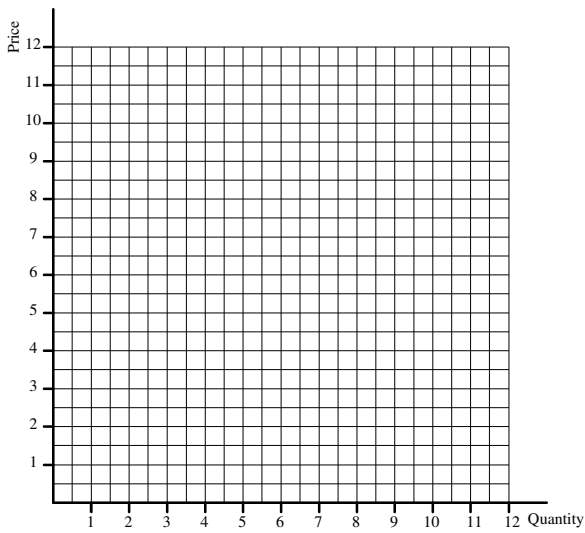
The (inverse) demand function is

$$P = 12 - Q$$

1. The following questions refer to the short run equilibrium:
  - a.) What is the supply curve of one firm,  $Q_{si}$ ?
  - b.) What is the (horizontally added) supply curve of the two firms in the market,  $Q_s$ ?
  - c.) What is the equilibrium price and quantity,  $P^*$  and  $Q^*$ , respectively?
  - d.) Determine the following:
    - a. Producer surplus of the individual firm
    - b. Producer surplus of the industry
    - c. Profit of the individual firm
    - d. Industry profit
    - e. Consumer surplus
    - f. Welfare
    - g. (Point) price elasticity of demand in the equilibrium price
  
2. The following questions refer to the introduction of a tax:
  - a.) Assume now that government imposes a tax of  $T= 2$ . Determine the following:
    - a. New aggregate supply curve of the two firms
    - b. Equilibrium price and quantity
    - c. Total tax revenues
    - d. Producer surplus of the individual firm
    - e. Producer surplus of the industry
    - f. Tax burden that producers roll over to consumers (in percent)
    - g. Profit of the individual firm
    - h. Industry profit
    - i. Consumer surplus
    - j. Welfare
    - k. Dead weight loss
    - l. (Point) price elasticity of demand in the (new) equilibrium price

3. The following questions refer to the long run equilibrium?

- a.) How many firms will be there in the long run?
- b.) Determine the following:
  - a. Producer surplus of the individual firm
  - b. Producer surplus of the industry
  - c. Profit of the individual firm
  - d. Industry profit
  - e. Consumer surplus
  - f. Welfare
  - g. (Point) price elasticity of demand in the equilibrium price

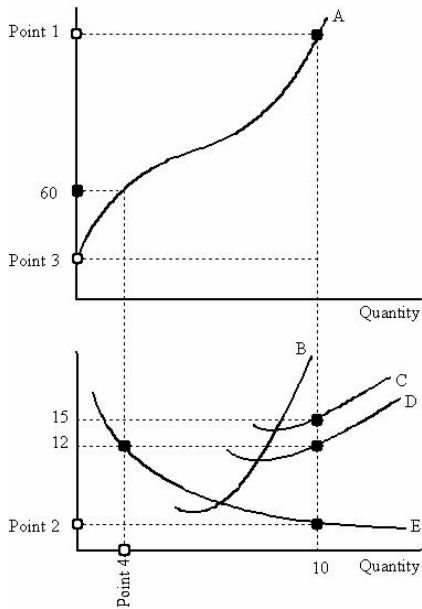




## CHAPTER 8: LONG RUN COSTS AND OUTPUT DECISIONS

### Problem 1: Cost Curves of Single-Product Firm

Below you see stylized cost curves.



1. What is the (vertical) value of Point 1?
  - a. 100
  - b. 150
  - c. 200
  - d. 300
  - e. 450
2. What is the (vertical) value of Point 2?
  - a. 1
  - b. 2
  - c. 3
  - d. 4
  - e. 5

3. What is the (vertical) value of Point 3?
  - a. 24
  - b. 26
  - c. 28
  - d. 30
  - e. 32

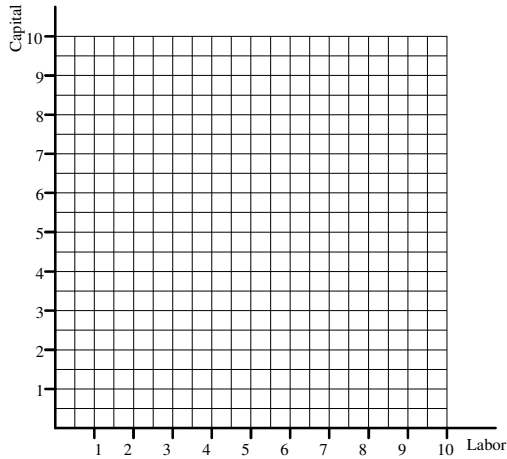
4. What is the (horizontal) value of Point 4?
  - a. 2
  - b. 2.5
  - c. 3
  - d. 3.5
  - e. 4

5. What is the average total cost associated with the (horizontal) value of Point 4?
  - a. 16
  - b. 18
  - c. 20
  - d. 22
  - e. 24

6. What is the average variable cost associated with the (horizontal) value of point 4?
  - a. 6
  - b. 8
  - c. 10
  - d. 12
  - e. Cannot be answered without additional information.

## Problem 2: Long-Run Cost Minimization

Given is the following production function of a firm:  $Q = K^2 \cdot L$ , where Q=Output, K=Capital, and L=Labor. The price for capital is  $p_K = 4$  and the price for labor  $p_L = 2$ . The company wants to produce  $Q=64$  at minimum costs.



- What is the cost minimizing relationship between K and L?
 

A.	$0.5K=L$
B.	$0.5L=K$
C.	$K=L$
D.	$K=4L$
- In the optimum, the firm will use
 

A.	$K=L=4$
B.	$K=2; L=16$
C.	$K=3, L=3$
D.	None of the above answers is correct
- What are the total costs of the cost minimizing output?
 

A.	22
B.	40
C.	18
D.	24
- Referring to the diagram with capital on the y-axis and labor on the x-axis, what is the marginal rate of transformation at  $L=1$ ?
 

A.	-2
B.	-4
C.	-6
D.	-8
- Assume that factor labor received training, increasing its productivity such that the production function becomes  $Q_{New} = K^2 \cdot L^2$ . Holding everything else constant, what is the new cost-minimizing relationship between K and L?
 

A.	Eight times as many L as K
B.	Twice as many K as L
C.	Twice as many L as K
D.	Eight times as many K as L
- The firm still produces  $Q=64$ . How many Ks and Ls does it use after factor labor received training?
 

A.	$L=8, K=1$
B.	$L=1, K=8$
C.	$L=4, K=2$
D.	$K=2, L=4$
- Comparing the old optimum to the new, the absolute marginal rate of transformation,  $l-dC/dL$ , at the new optimum is
 

A.	greater than in the old
B.	smaller than in the old
C.	the same as in the old
D.	Cannot be answered without additional information
- Assuming that the training of factor labor caused cost of  $C_{Training}=10$ , then, holding everything else constant, the investment has
 

A.	increased the company's profit
B.	decreased the company's profit
C.	left the company's profit unchanged
D.	cannot be answered without knowing the company's profits

## CHAPTER 9: INPUT DEMAND: LABOR MARKETS

### Problem 1: Demand for Factor Labor

Fill out the table below and derive the demand function for labor.

L	TO	MP	P	MRP	w
0	0		10		40
1	10		10		40
2	18		10		40
3	24		10		40
4	28		10		40
5	30		10		40

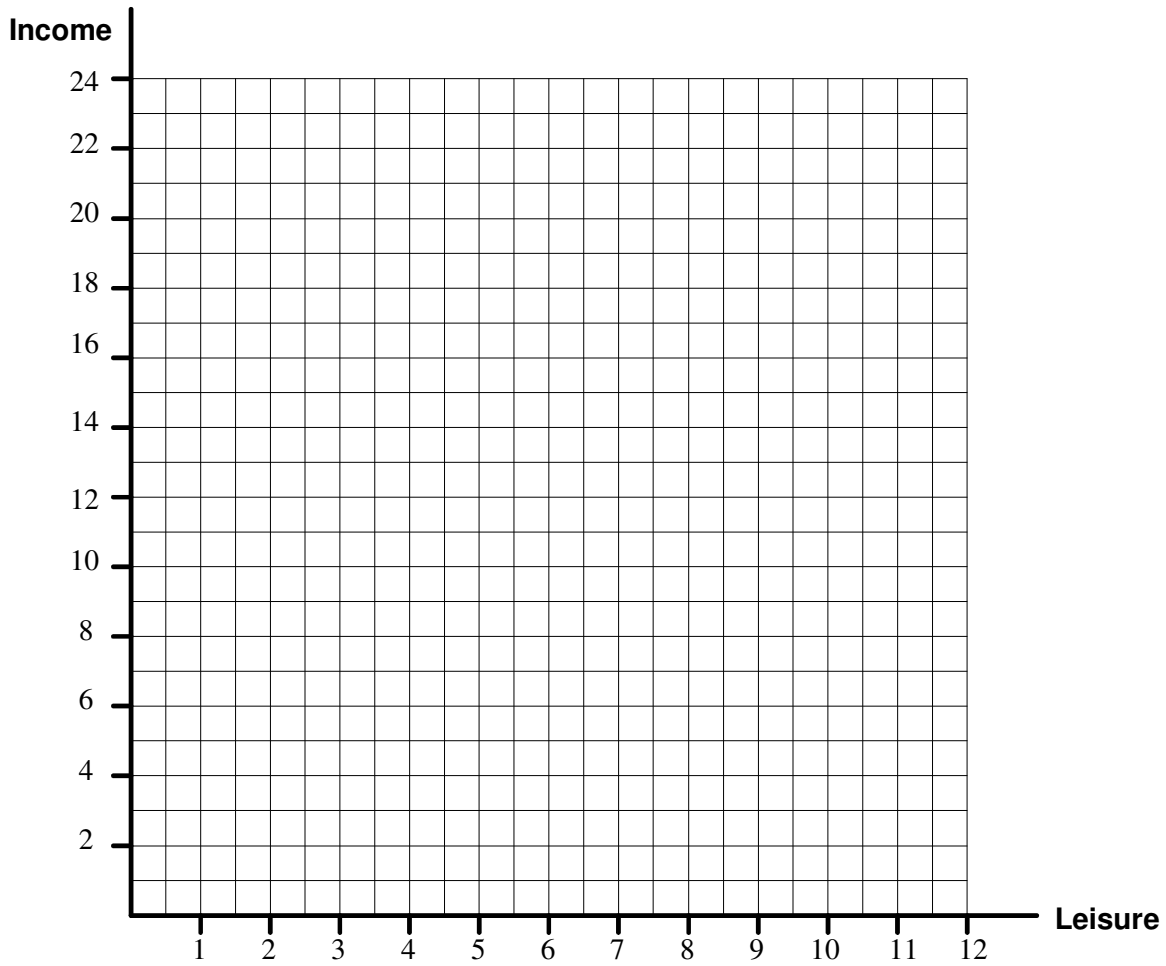
## Problem 2: Income and Substitution Effect in the Labor Market

Your utility function is  $U = Y \cdot L^{\left(\frac{2}{w}\right)}$

where  $Y$ =Income,  $L$ =leisure, and  $w$ =wage rate. Your income is  $Y=w \cdot L$ . Assume that you have reserved a minimum of 12 hours per day for sleeping and spending time with your family and friends so that your maximum working hours offered are 12 hours. Assume further that the wage rate is initially  $w=1$ . Draw the consumption possibility frontier (CPF) of income and leisure in the graph below (watch the orthogonal scale!)

- Write the CPF as  $Y=F(L)$ .
- How does the marginal utility of leisure change as the wage rate increases.
- What is the opportunity cost of one hour of leisure?
- How many hours do you work when the wage rate is  $w=1$ .
- How many hours do you work, when the wage rate goes up to  $w=2$ .
- Determine the substitution and income effect with respect to leisure.

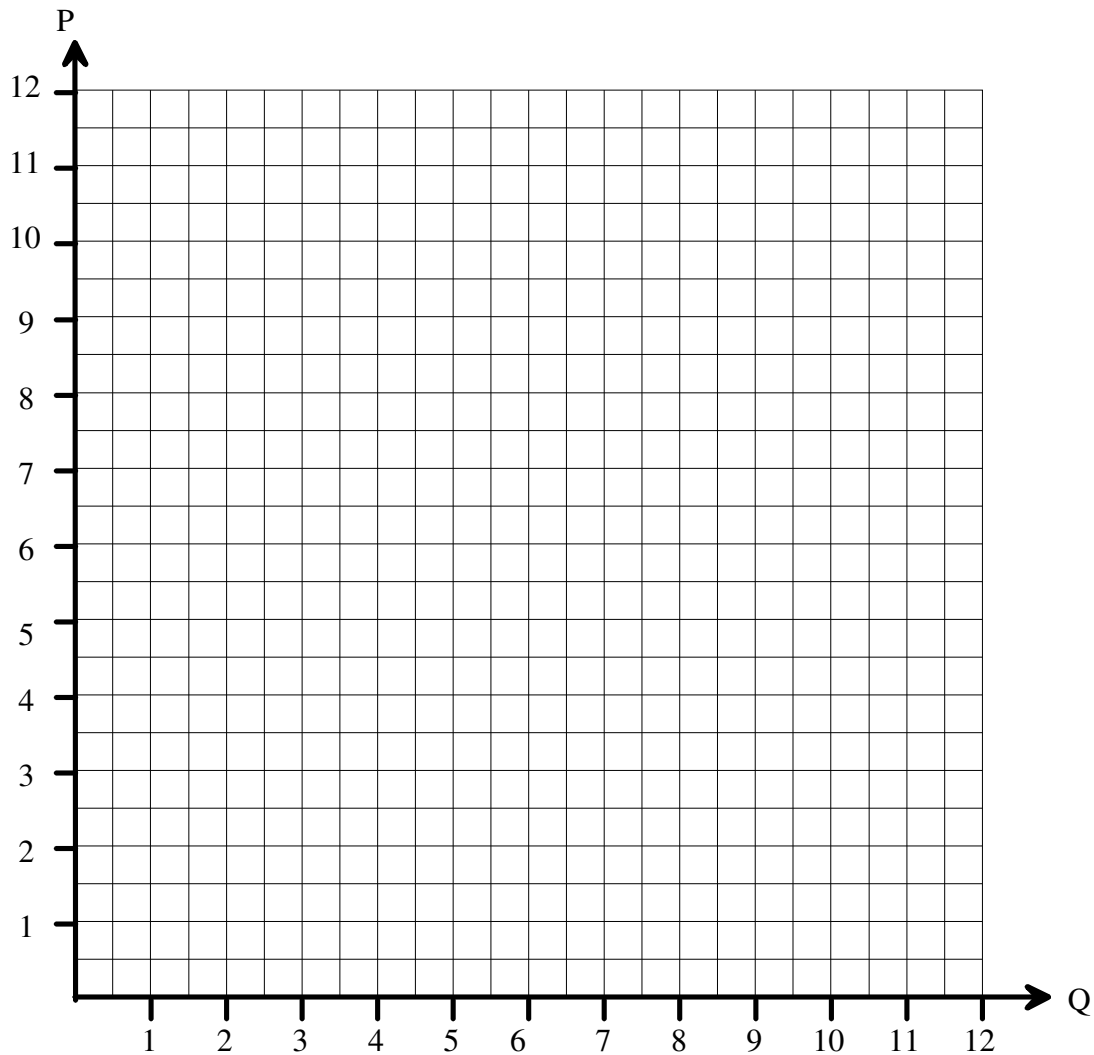
Show all your work both graphically and mathematically.



## CHAPTER 12: MONOPOLY AND ANTITRUST POLICY

### Problem 1: Monopoly, Perfect Competition, and Cartel

Given is the market demand curve  $D: P=12-Q$ .



- a.) Assume a competitive market with 2 firms. Each firm has the following total cost function (TC):

$$TC=2Q+Q^2+1 \quad (1)$$

Fill out the following tables:

Derive the short run equilibrium

**Problem 1: Monopoly, Perfect Competition, and Cartel (Contd.)**

	Short-Run Market Equilibrium
Market price	
Market quantity	
Consumer surplus	
Total Producer surplus	
Welfare	
Price elasticity of demand in equilibrium	
Quantity supplied firm 1	
Quantity supplied firm 2	
Producer surplus firm 1	
Producer surplus firm 2	
Profit firm 1	
Profit firm 2	
Firm's price elasticity of demand in equilibrium	

b.) Derive the long run equilibrium.

	Long-Run Market Equilibrium
Market price	
Market quantity	
Consumer surplus	
Total Producer surplus	
Welfare	
Price elasticity of demand in equilibrium	
Number of firms	
Quantity supplied by typical firm	
Producer surplus typical firm	
Profit of typical firm	
Firm's price elasticity of demand in equilibrium	

c.) Now, holding everything else constant, derive the monopoly equilibrium.

	Monopoly Equilibrium
Market price	
Market quantity	
Consumer surplus	
Producer surplus	
Welfare	
Profit	
Market Elasticity	

**Problem 1: Monopoly, Perfect Competition, and Cartel (Contd.)**

d.) Now, assuming two firms again as under a.), derive the cartel solution.

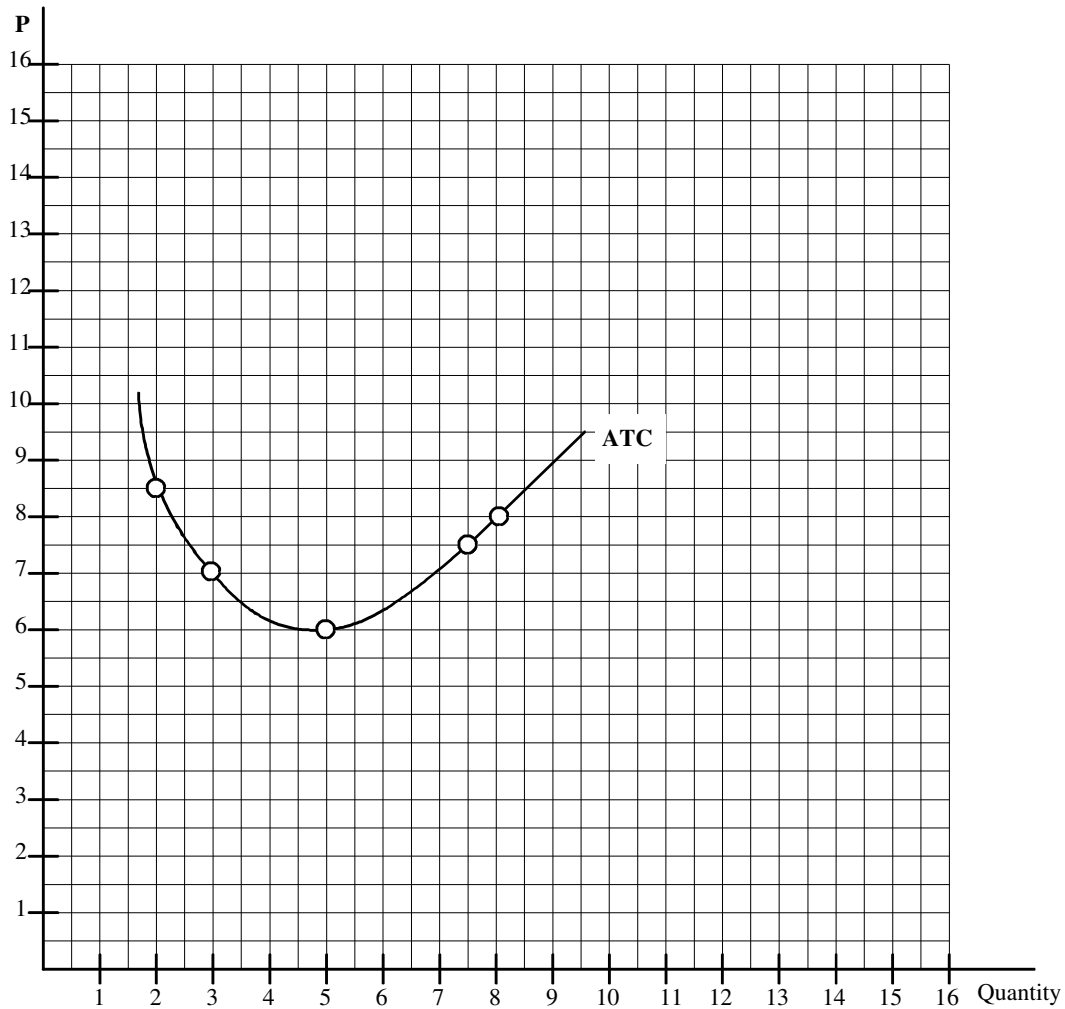
	Cartel Equilibrium
Market price	
Market quantity	
Quantity supplied by Firm 1	
Quantity supplied by Firm 2	
Consumer surplus	
Total producer surplus	
Producer surplus Firm 1	
Producer surplus Firm 2	
Welfare	
Profit Firm 1	
Profit Firm 2	

## CHAPTER 13: MONOPOLISTIC COMPETITION AND OLIGOPOLY

### Problem 1: Perfect Competition, Monopolistic Competition, and Monopoly

In order to answer the following questions 1 to 23, you may want to draw graphs into the diagram MS1 below, where you already see the average total cost curve (ATC) of a typical firm. The market demand function (not drawn into the graph) is  $Q_D = 16 - P$ .

Diagram MS1



1. Given is the market demand function  $Q_D = 16 - P$ . The inverse demand function,  $P(Q)$ , is then

$P = 16 - 0.25 \cdot Q$	A
$P = 16 - 0.5 \cdot Q$	B
$P = 16 - Q$	C
$P = 16 - 2 \cdot Q$	D
There is no inverse market demand function, because $Q_D$ is linear (so-called linearity prohibits inversivity theorem).	E



2. What is the (absolute) arc elasticity of demand associated with a decrease in price from P=13 to P=11.

4.33	A
1	B
Infinity	C
3	D
2	E

3. Which value has the point price elasticity of demand at P=6?

0.5	A
0.6	B
1	C
4	D
60	E

4. If price decreases from P=13 to P=11, how big is the decrease in total revenue that is due to the decrease in price?

2	A
4	B
6	C
8	D
10	E

5. If price decreases from P=13 to P=11, how big is the increase in total revenue that is due to the increase in quantity?

22	A
33	B
66	C
44	D
55	E

6. In the diagram you see the firm's ATC function. Which marginal cost function fits the ATC best in terms of the relationship between MC and ATC?

$MC = 1 + \frac{1}{4} Q^3$	A
$MC = 2 + 2Q^2$	B
$MC = 4$	C
$MC = 1 + 4 \cdot Q$	D
$MC = 1 + Q$	E

7. Assume that the firm has the total cost function  $TC = \frac{1}{2} Q^2 + 1 \cdot Q + \text{Fixed Cost}$ , what is the firm's marginal cost function?

$MC = 1 + \frac{1}{4} Q^2$	A
$MC = 2 + 2Q^2$	B
$MC = 4$	C
$MC = 1 + 4 \cdot Q$	D
$MC = 1 + Q$	E

8. Assume that the firm has the total cost function  $TC = \frac{1}{2}Q^2 + 1 \cdot Q + \text{Fixed Cost}$ , which statements is true?

As fixed costs go up, marginal costs go down.	A
As fixed costs go up, marginal costs go up.	B
As fixed costs go up, marginal costs stay the same.	C
As fixed costs go up, average variable costs go up.	D
None of the above statements is true.	E

**The following questions 9 to 12 assume that the firm is operating under perfect competition.**

9. Before answering the next question, keep in mind: In economics, if no consumer can be served anymore at extra costs that are lower than the extra consumer's willingness to pay, then economists speak of allocative efficiency. Similarly, if firms operate at the least possible cost (i.e. minimum of ATC), then economists speak of production efficiency. Assuming that the supply curve of the individual firm is  $P = 1 + Q$  and the market price is  $P=8.5$ , which statement is true?

The firm operates in a short-run equilibrium.	A
The firm's total cost are 56.25	B
The firm must anticipate market entry.	C
In terms of production efficiency, the firm produces inefficiently.	D
All above statements are true.	E

10. What will be the market price in the long run equilibrium?

6.5	A
6	B
5.5	C
5	D
4.5	E

11. How many firms will operate in the long-run equilibrium?

10	A
5	B
2	C
3.33	D
4	E

12. Which of the following statements is true? In the long run equilibrium, producer surplus is equal to

Profit	A
Fixed cost	B
Total variable cost	C
Zero	D
Consumer surplus	E

The following questions 13 to 20 assume that the firm is a monopolist.

13. What is the monopolist's marginal revenue function?

$MR = 16 - 0.5 \cdot Q$	A
$MR = 16 - Q$	B
$MR = 16 - 2 \cdot Q$	C
$MR = 8 - 0.5 \cdot Q$	D
$MR = 8 - Q$	E

14. After drawing the monopolist's marginal revenue function into the diagram, which (absolute) value has the point price elasticity of demand where  $MR=0$ ?

0	A
1	B
2	C
3	D
4	E

15. Assume that the monopolist operates at  $MC = 1 + Q$ , what is the monopolist's supply function?

$P = 1 + Q$	A
$P = 1 \cdot Q + \frac{1}{2} \cdot Q^2$	B
$P = 16 - Q$	C
$P = 11$	D
The monopolist does not have a supply function.	E

16. Assume that the monopolist operates at  $MC = 1 + Q$ , what is equilibrium price and quantity, {Price, Quantity}?

{Price=6, Quantity=5}	A
{Price=13, Quantity=3}	B
{Price=11, Quantity=5}	C
{Price=10, Quantity=6}	D
{Price=12, Quantity=4}	E

17. In economics, if no consumer can be served anymore at extra costs that are lower than the extra consumer's willingness to pay, then economists speak of allocative efficiency. Similarly, if firms operate at the least possible cost (i.e. minimum of ATC), then economists speak of production efficiency. Keeping this in mind, assume that the monopolist operates at  $MC = 1 + Q$ , which statement with respect to efficiency is true?

Both allocation and production efficiency is given	A
Neither production, nor allocation efficiency is given	B
Allocation efficiency is given, but not production efficiency	C
Production efficiency is given, but not allocation efficiency	D
This answer cannot be answered without additional information	E

18. Assume that the monopolist operates at  $MC = 1 + Q$ , how big is the society's welfare?

100	A
75	B
68	C
50	D
40	E

19. Assume a regulator forces the monopolist to price at marginal cost,  $MC = 1 + Q$ , how much would the society as a whole gain in welfare?

Nothing, because as soon as the state intervenes, things get only worse	A
25	B
12.5	C
6.25	D
This cannot be measured, but people will be very thankful and probably dance on the street.	E

20. Assume a regulator forces the monopolist to price at marginal cost,  $MC = 1 + Q$ , how would that effect the monopolist's profit?

Profits increase by 7.5, because of the beneficial demand elasticity	A
Profits stay the same, because the regulation takes place at the unitary elastic part of demand	B
Profits go down by 17.5	C
Profits go down by 10	D
This question cannot be answered.	E

**The following question 21 to 23 assume that the firm operates under monopolistic competition.**

21. If the firm operates under monopolistic competition, which of the following residual demand functions – this is the demand function, which the individual firm faces in its product-differentiated market segment – would be compatible with a long-run equilibrium?

$P_R = 10 - Q$	A
$P_R = 10 - 2 \cdot Q$	B
$P_R = 10 - 0.5 \cdot Q$	C
$P_R = 6$	D
None of the above	E

22. After having identified the firm's residual demand in the long run equilibrium, how many firms will be in the market?

1	A
2	B
3	C
4	D
5	E

23. From a welfare perspective, how could economic policy increase welfare?

Economic policy cannot do anything; welfare cannot be increased anymore.	A
Economic policy should allow for even more competition; there is still too little competition.	B
Economic policy should restrict competition, there is too much of it.	C
Economic policy should set the price to $P=7$ .	D
Economic policy should split up the companies in even more units.	E

## Problem Set 2: Game Theory

To solve the questions 1 to 3, refer to Table GT 1 below.

Table GT 1:

		PLAYER 2			
		Left		Right	
PLAYER 1	Up	Player 1 Payoff: 3	Player 2 Payoff: 2	Player 1 Payoff: 2	Player 2 Payoff: 1
	Down	Player 1 Payoff: 2	Player 2 Payoff: 1	Player 1 Payoff: 0	Player 2 Payoff: 0.5

1. For player 1,

Strategy “Down” strictly dominates strategy “Up”	A
Strategy “Up” strictly dominates strategy “Down”	B
All of the above	C
None of the above	D
Initially, strategy “Up” is dominant, but towards the end of the game strategy “Up” becomes dominated by “Down.”	E

2. For Player 2,

Strategy “Right” strictly dominates strategy “Left”	A
Strategy “Left” strictly dominates strategy “Right”	B
All of the above	C
None of the above	D
Initially, strategy “Left” is dominant, but towards the end of the game strategy “Right” becomes dominated by “Up.”	E

3. The Nash equilibrium of the game described in Table GT 1 is

(Up for Player 1, Left for Player 2)	A
(Up for Player 1, Right for Player 2)	B
(Down for Player 1, Left for Player 2)	C
(Down for Player 1, Right for Player 2)	D
None of the above	E

Now, for question 4, consider the following table GT 2:

Table GT 2:

		REBEL			
		North		South	
GOVERNMENT	North	Government Payoff: 1	Rebel Payoff: -1	Government Payoff: -1	Rebel Payoff: 1
	South	Government Payoff: -1	Rebel Payoff: 1	Government Payoff: 1	Rebel Payoff: -1

4. The Nash equilibrium described in Table GT 2 is:

(North for Government, North for Rebel)	A
(North for Government, South for Rebel)	B
(South for Government, North for Rebel)	C
(South for Government, South for Rebel)	D
None of the above	E

Now, for questions 5 to 6, assume the following scenario:

Consider a game with two buddies, Yasmine and Samuel. They prefer, as described in Table GT 3, to hang out together rather than to be alone. Yasmine and Samuel have to decide simultaneously and independently from each other whether to go to the stadium or the opera.

Table GT 3:

		SAMUEL			
		Opera		Stadium	
YASMINE	Opera	Yasmine Payoff: 2	Samuel Payoff: 1	Yasmine Payoff: 0	Samuel Payoff: 0
	Stadium	Yasmine Payoff: 0	Samuel Payoff: 0	Yasmine Payoff: 1	Samuel Payoff: 2

5. Which of the following statements is TRUE?

(Opera for Yasmine, Stadium for Samuel) is a Nash equilibrium	A
(Stadium for Yasmine, Opera for Samuel) is a Nash equilibrium	B
Both A. and B. are correct	C
Both (Opera for Yasmine, Opera for Samuel) and (Stadium for Yasmine, Stadium for Samuel) are Nash equilibria	D
None of the above.	E

6. Which of the following statements is TRUE?

Samuel always prefers stadium to opera.	A
Yasmine always prefers opera to stadium.	B
Both A. and B. are correct.	C
As long as Samuel and Yasmine are together, neither one matters where they are.	D
None of the above is true.	E