

SUGGESTED SOLUTIONS FOR MAY/JUNE 2015

QUESTION 1

1a. Consider the following baskets of goods:

	FOOD	CLOTHING
A	8	3
B	6	6
C	3	8

If preferences satisfy all requirements, is A preferred to C or C to A? Explain your answer.

Basket A has more food than basket C.

Basket C has more clothing than basket A.

Therefore, basket A and C cannot be compared without additional information.

1b. An island economy produces only two goods – coconuts and pineapples. There are five people (A, B, C, D and E) living on the island, with these preferences:

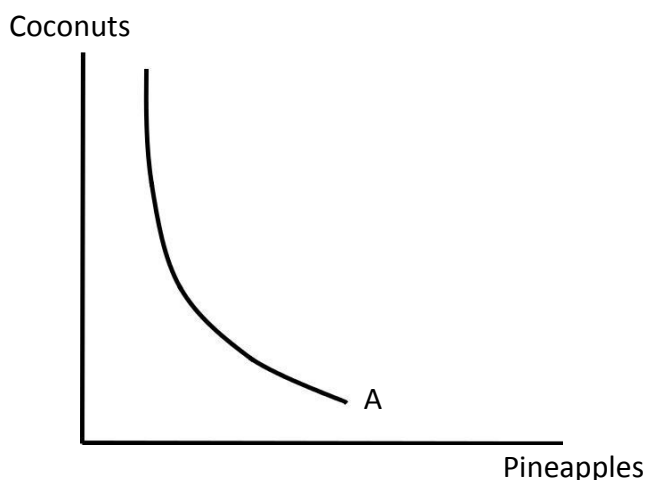
A has a strong preference for pineapples. B has a strong preference for coconuts.

C doesn't care for pineapples (assigns no value to them). D doesn't care for coconuts (assigns no value to them).

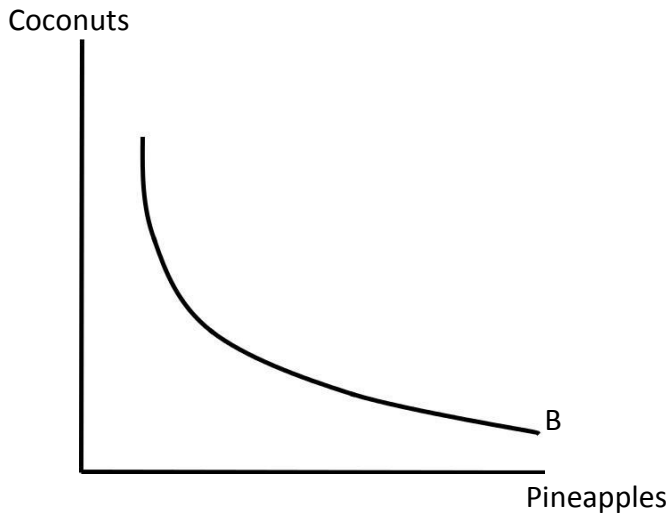
E will only consume pineapples and coconuts in the fixed proportion of one pineapple to one coconut.

For each of these five individuals, construct a representative indifference curve with pineapples on the horizontal axis and coconuts on the vertical axis.

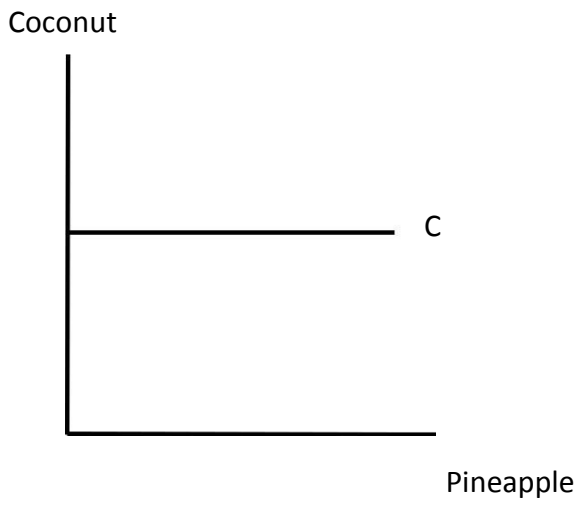
Person A:



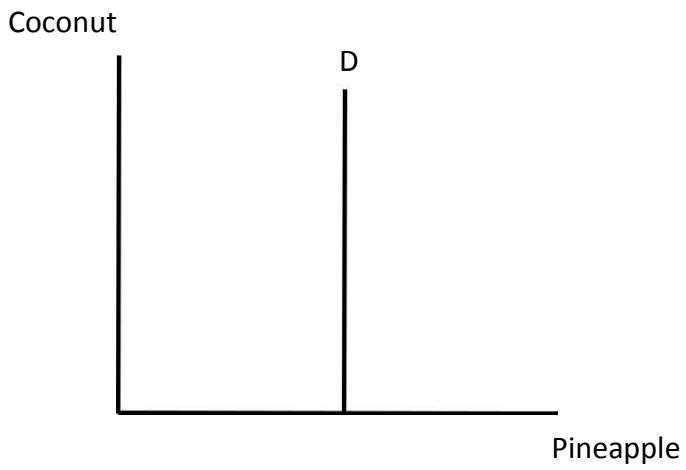
Person B:



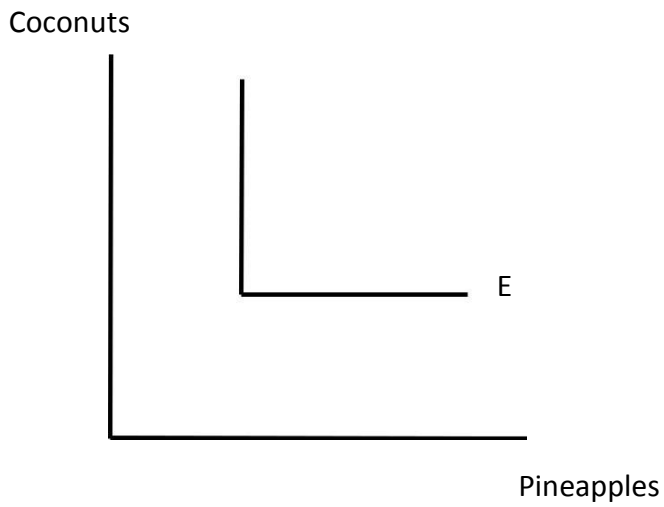
Person C:



Person D:

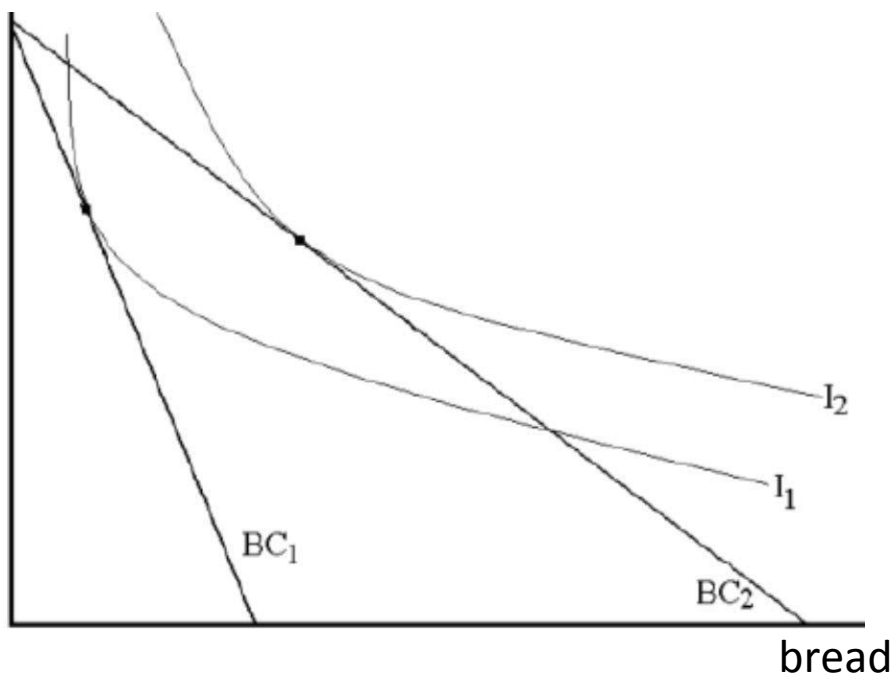


Person E:

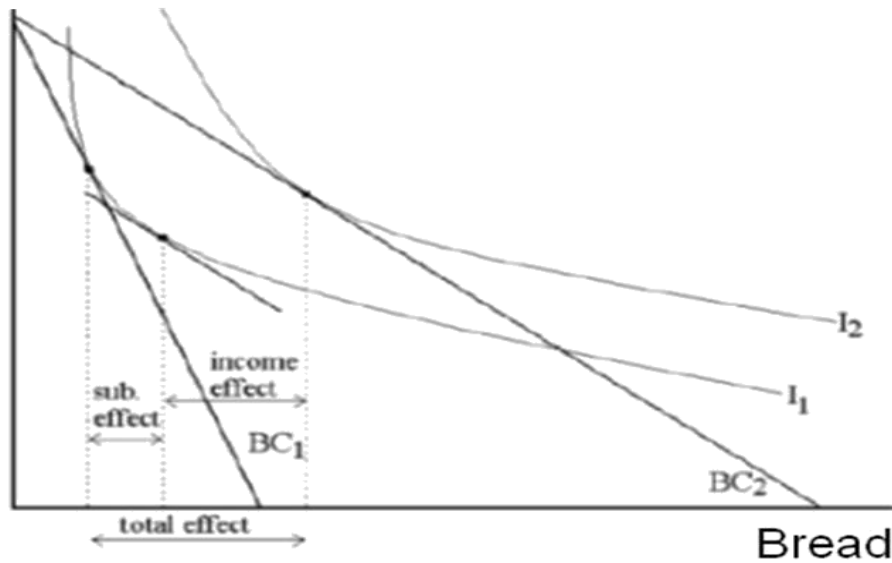


1c. The diagram below depicts the change in optimal consumption bundles for Kgomotso when the price of bread decreases. Decompose the change into the income and substitution effects. Indicate the total effect, income effect and substitution effect in the diagram. (6 marks)

Food



Food



A hypothetical budget line must be constructed to show income effect, substitution effect and total effect.

QUESTION 2

2a. A fast-food restaurant currently pays R20 per hour for labour and R40 per hour to rent ovens and other kitchen machinery. The restaurant uses seven hours of labour time per unit of machinery time.

(i) Determine whether the restaurant is minimising its cost of production when the ratio of marginal products (capital to labour) is 10.

If the firm is minimizing its costs of production, then the MRTS will equal a ratio of prices of inputs.

**The ratio of prices $P_K / P_L = R40 / R20 = 2$
And the MRTS of capital for labour (MP_K / MP_L) = 10.**

Since these two ratios are not equal, the firm is not minimizing costs.

(ii) If not, what adjustments are called for to improve the efficiency of resource use? (2 marks)

To increase efficiency in the use of inputs, the firm should use more capital and use less labour to make the ratios equal.

Since these two ratios are not equal, the firm should change the mix of inputs.

2b. (i) The following table contains information for a price taking competitive firm. Complete the table

Output	Total Cost	Marginal Cost	Fixed Cost	Average Cost	Total Revenue	Average Revenue	Marginal Revenue
0	25	-	25	-	0	-	-
1	35	10	25	35	25	25	25
2	60	25	25	30	50	25	25
3	105	45	25	35	75	25	25
4	185	80	25	46.25	100	25	25
5	285	100	25	57	125	25	25
6	405	120	25	67.5	150	25	25

(ii) Determine the profit maximizing level of output

**The profit maximizing level of output is where MR = MC.
MR = MC at the level of 2. Hence should produce 2 units of output.**

QUESTION 3

3a. Suppose a firm can practice perfect, first-degree price discrimination. What is the lowest price it will charge, and what will its total output be? (4 marks)

First-degree price discrimination is a practice of charging each customer her reservation price.

**Hence the lowest price it will charge will be marginal cost (i.e. $P = MC$)
and the output will be where $MC = AR$ (ie. the demand curve)**

3b A monopolist faces the following demand curve, marginal revenue curve, total cost curve and marginal cost curve for his product:

$$Q = 200 - 2P$$

$$MR = 100 - Q$$

$$TC = 5Q$$

$$MC = 5$$

(i) What is the profit maximising level of output?

**Profit is max when the firm produce at output level where $MR = MC$
Find Q where $MR = MC$
 $100 - Q = 5$
 $Q = 95$**

What is the profit maximising price

$$Q = 200 - 2P \quad 95 = 200 - 2P$$

$$2P = 200 - 95 = 105$$

$$P = 52.5$$

(iii) What is the total profit earned?

$$\text{Profit} = \text{TR} - \text{TC}$$

When firm produces 95 units, $\text{TR} = P \times Q = R52.5 \times 95 = R4950$, while $\text{TC} = 5 \times 95 = 475$

$$\text{Profit} = R4950 - R475 = R4475$$

3b The two leading South African manufacturers of high performance radial tires must formulate their advertising strategies for the coming year. Each firm has two strategies available: maintain current advertising; or increase advertising by 15%. The strategies available to the two firms, A and B, are presented in the payoff matrix below:

	Firm B increases advertising	Firm B maintains advertising
Firm A increases advertising	18; 18	30; 6
Firm A maintains advertising	6; 30	24; 24

The entries in the individual cells are profits measured in millions of rands. Firm A's outcome is listed before the semicolon (;) and Firm B's outcome is listed after the semicolon (;).

(i) Which oligopoly model in the game theory is best suited for analysing this decision?

The prisoner's dilemma model is most appropriate for analysing this situation.

(ii) If each firm tries to choose a strategy that is best for it, regardless of the other firm's strategy, which strategy would firm B and firm A choose? Support your choice by using the given firm's payoffs. (6 marks)

Increasing the advertising level is the dominant strategy, since the firm is better off increasing regardless of the rival's action.

For example, if Firm B increases, Firm A earns 18 if it increases and 6 if it does not increase. A is better off to increase advertising.

If Firm B doesn't increase, Firm A earns 24 by not increasing and 30 by increasing. Again, Firm A is better off to increase.

It is obvious that no matter what B does, A is better off to increase.

The same reasoning works for firm B as well. Increasing the advertising level is also the best strategy for firm B.

2015 MAY/JUNE SECTION B

1. 2
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18. 3
19. 4
20. 5
21. 2
22. 3
23. 2
24. 3
25. 3
26. 2
27. 4
28. 4
29. 4
30. 5

SUGGESTED SOLUTIONS FOR MAY/JUNE 2014

1a. Consider the following baskets of goods:

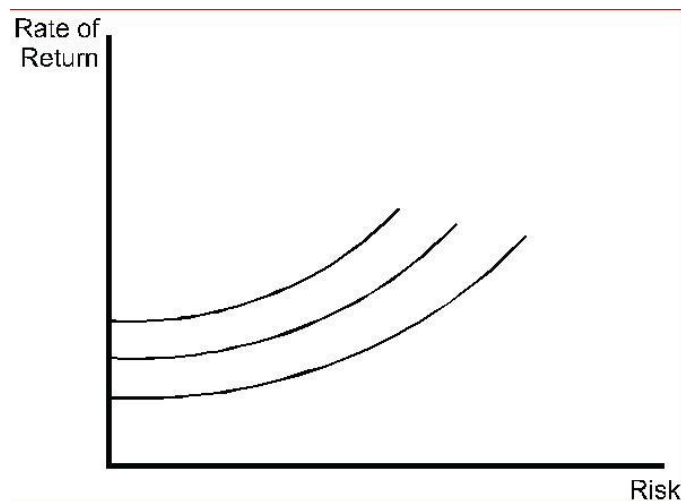
	FOOD	CLOTHING
A	8	3
B	4	5
C	5	8

If preferences satisfy all requirements, is A preferred to B or B to A? Explain your answer

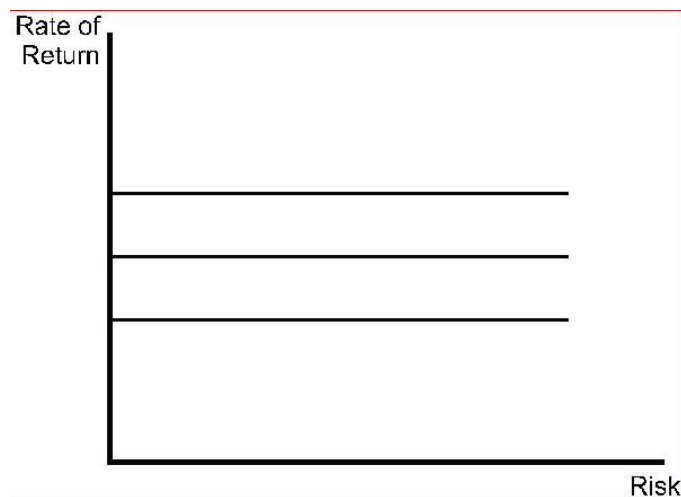
A has more food than B.
While B has more clothing than A.
A and B cannot be compared without additional information.

1b. In the field of financial management it has been observed that there is a trade-off between the rate of return that one earns on investments and the amount of risk that one must bear to earn that return.

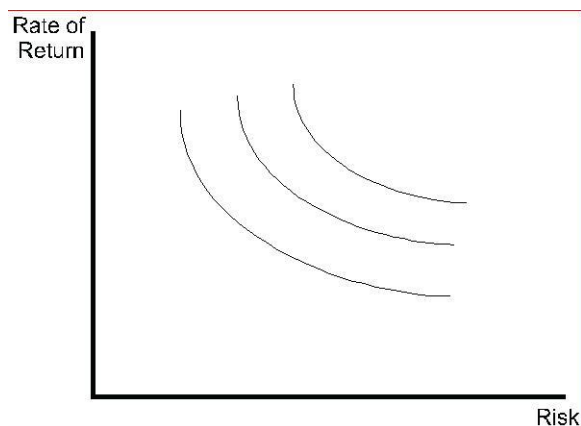
(i). Draw a set of indifference curves between risk and return for a person that is risk averse (a person that does not like risk).



(ii). Draw a set of indifference curves for a person that is risk neutral (a person that does not care about risk one way or the other).

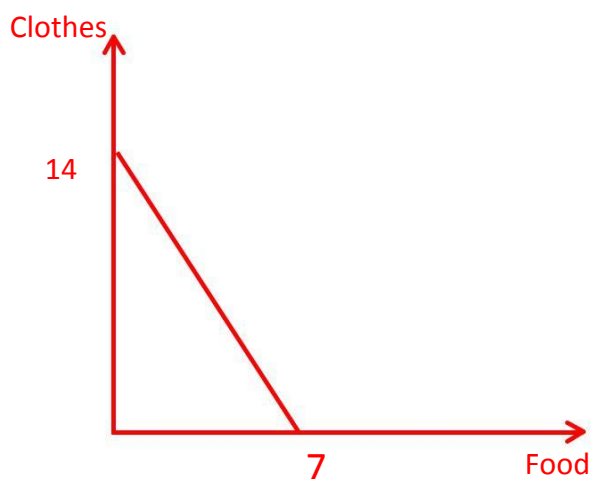


(iii). Draw a set of indifference curves for a person that likes risk. (2 marks)

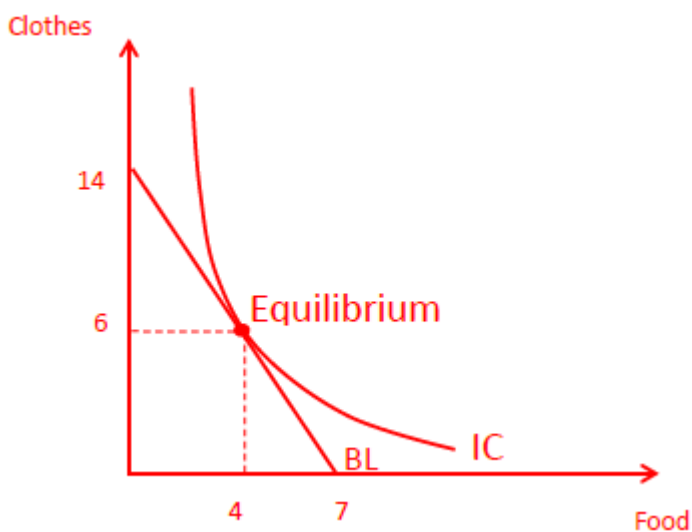


(1c) Lindiwe has a budget of R140. The price of food is R20 and the price of clothes is R10. She maximises her utility by buying 4 units of food and 6 units of clothes.

(i) Draw a budget line, with food on the horizontal axis.



(ii) Suppose an indifference map exists, show her equilibrium point on the diagram above. (2 marks)



(iii) Which condition must be satisfied to gain equilibrium? (2 marks)

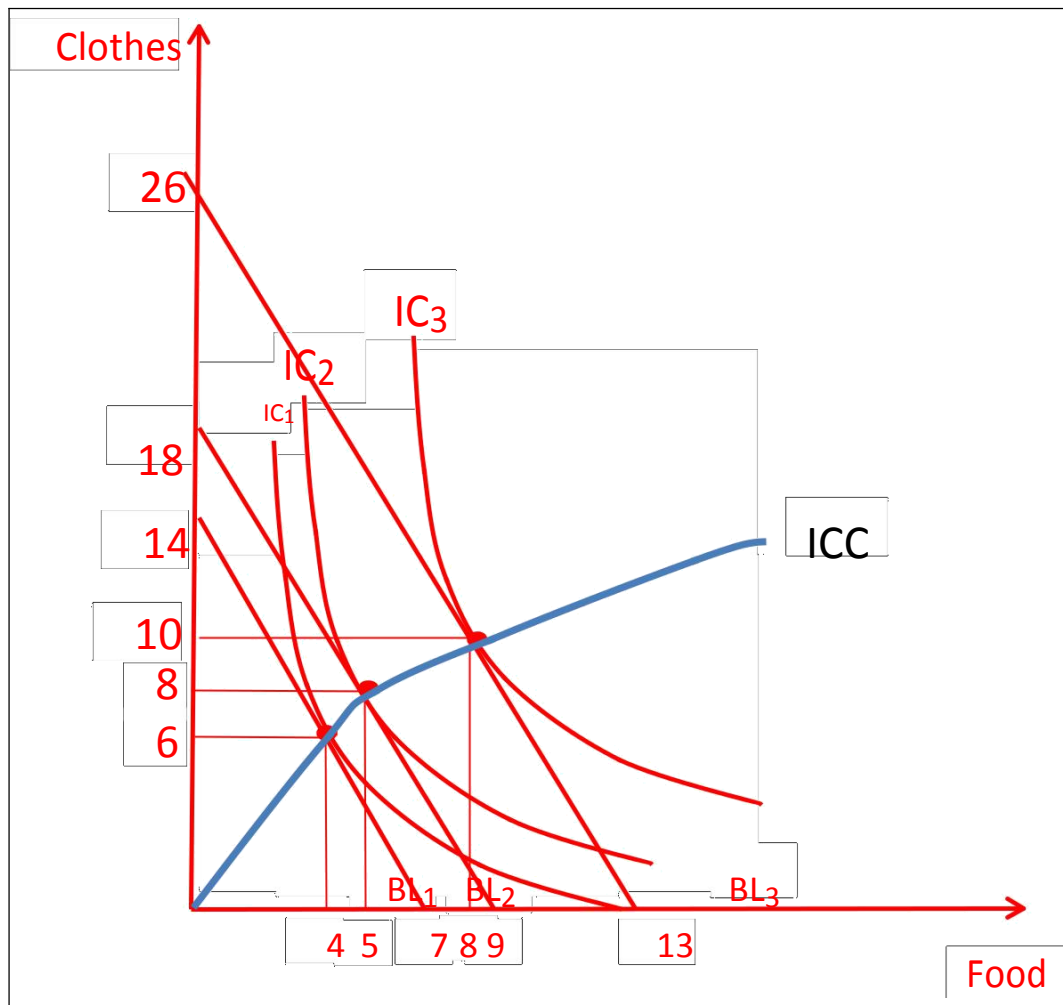
$$\text{MRS} = P_f / P_c$$

Or The slope of the IC = the slope of the budget line

Or The IC tangents to the budget line

$$\text{Or } MU_f / MU_c = P_f / P_c$$

(iv) When the income of Lindiwe increases to R180, she then maximise her utility by buying 5 units of food and 8 units of clothes. When the income increases to R260, she buys 8 units of food and 10 units of clothes. From the information given in (i) and (iii), draw an indifference curve map for Lindiwa indicating all equilibrium positions and also derive her income consumption curve. (5 marks)



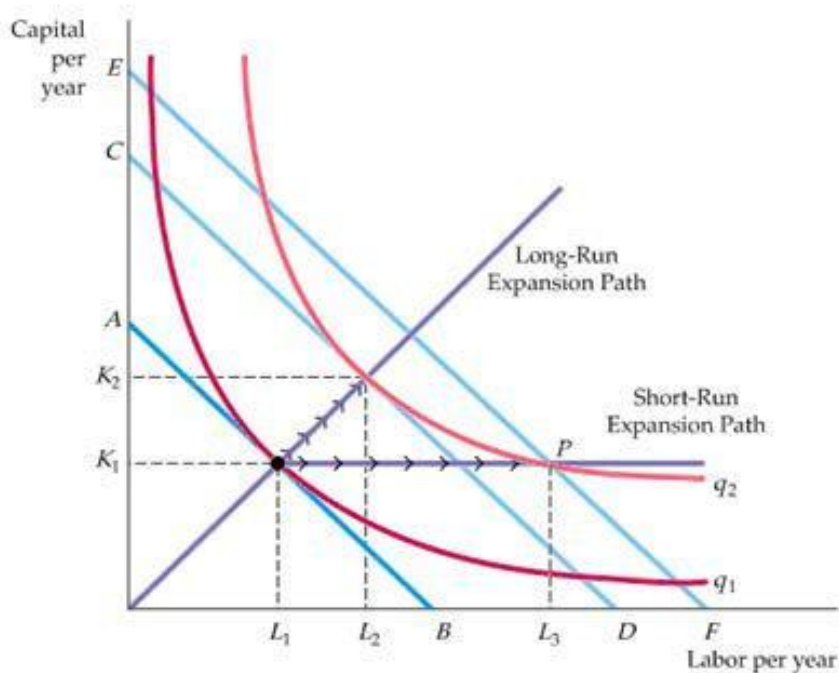
2a. For a producer that uses 6 units of labour at a wage rate of R20 000 per year and R400 000 worth of capital, work out the producer's total cost of production per year, given an interest rate of 12%. (4 marks)

$$\text{TC} = wL + rK$$

$$= R20\ 000 \times 6 + R400\ 000 \times 12\%$$

$$= R168\ 000$$

b. Use an isoquant map with associated isocost curves to explain that when capital is allowed to vary (the long run), a producer can expand and attain a level of output that is the same as when capital is fixed (the short run), however, at a lower total cost. (6 marks)



When a firm operates in the short run, its cost of production may not be minimized because of inflexibility in the use of capital inputs.

Output is initially at level q_1 . In the short run, output q_2 can be produced only by increasing labor from L_1 to L_3 because capital is fixed at K_1 .

In the long run, the same output can be produced more cheaply by increasing labor from L_1 to L_2 and capital from K_1 to K_2 .

(c) A monopolist faces the following demand curve, marginal revenue curve, total cost curve and marginal cost curve for its product:

$$Q = 200 - 2P$$

$$MR = 100 - Q$$

$$TC = 10Q$$

$$MC = 10$$

(i) What is the profit maximising level of output?

Profit is max when the firm produce at output level where $MR = MC$

Find Q where $MR = MC$

$$100 - Q = 10$$

$$Q = 90$$

(ii) What is the profit maximising price?

(3)

$$Q = 200 - 2P$$

$$90 = 200 - 2p$$

$$2p = 110$$

$$P = 55$$

(iii) What is the total profit earned? (3)

$$\text{Profit} = \text{TR} - \text{TC}$$

$$\text{When firm produces 90 units, TR} = P \times Q = R55 \times 90 = 4950, \text{ while TC} = 10 \times 90 = 900 \quad (1)$$

$$= 4950 - 900$$

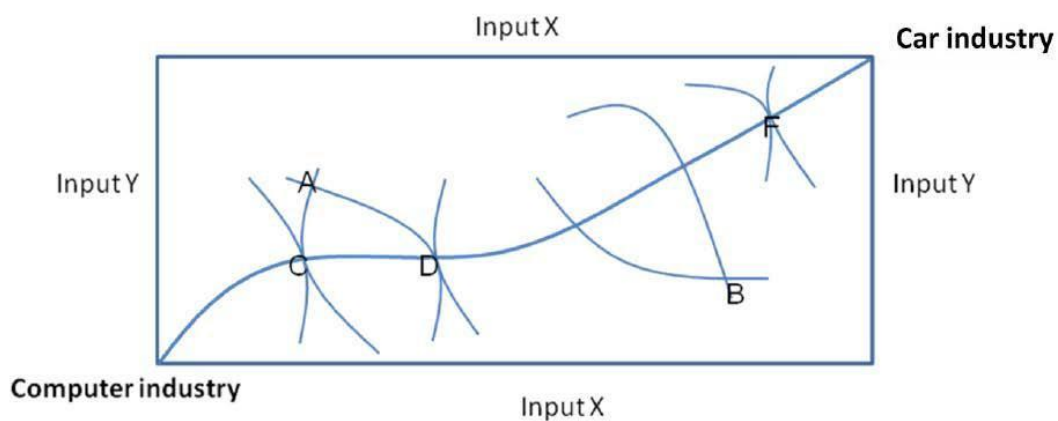
$$\text{Profit} = 4050$$

3a (i). Explain the *efficiency in production* of two industries (the car industry and the computer industry) with two inputs, X and Y. (2 marks)

Every producer's marginal rate of technical substitution between input X and Y are equal to their factor price ratio

OR MRTS = P_x / P_y

Answer the following questions based on the Edgeworth box diagram below.



(ii) What is the line joining points C, D and F called? (2 marks)

Contract curve.

(iii) List any two points where production is inefficient. (2 marks)

A and B.

(iv) A movement from point A to point D will be to the benefit of which of the two industries? Explain your answer in no more than three sentences. (4)

It will benefit computer industry while car industry remains the same.

It is because this movement increase the output of computer industry by moving the isoquant outward / to a higher level of isoquant while the isoquant of car industry remains the same.

(v) At point C, which of the two industries is dominant? (2)

Car industry.

3b (i) The two leading South African manufacturers of high performance radial tires must set their advertising strategies for the coming year. Each firm has two strategies available: maintain current advertising or increase advertising by 15%. The strategies available to the two firms, G and B, are presented in the payoff matrix below.

		Firm B	
		Increase Adv.	Maintain Adv.
Firm G	Increase Adv.	27, 27	50, 12
	Maintain Adv.	12, 50	45, 45

The entries in the individual cells are profits measured in millions of rands. Firm G's outcome is listed before the comma, and Firm B's outcome is listed after the comma.

Which oligopoly model in the game theory is best suited for analyzing this decision? (2 marks)

The prisoner's dilemma model is most appropriate for analysing this situation.

B (ii) Carefully explain the strategy that should be used by each firm. Support your choice by including numbers. (6 marks)

Increasing the advertising level is the dominant strategy, since the firm is better off increasing regardless of the rival's action.

For example, if Firm B increases, Firm G earns 27 if it increases and 12 if it does not increase. G is better off increasing.

If Firm B doesn't increase, Firm G earns 45 by not increasing and 50 by increasing. Again, Firm G is better off to increase.

It is obvious that no matter what B does, G is better off to increase. Firm B faces the same situation.

2014 MAY/JUNE SECTION B

- 1. 2
- 2. 1
- 3. 2
- 4. 1
- 5. 3
- 6. 3
- 7. 2
- 8. 2
- 9. 1
- 10. 4
- 11. 1
- 12. 2
- 13. 5
- 14. 4
- 15. 5
- 16. 4
- 17. 3
- 18. 3
- 19. 3
- 20. 2
- 21. 1
- 22. 1
- 23. 5
- 24. 2
- 25. 2
- 26. 2
- 27. 1
- 28. 4
- 29. 1
- 30. 1

ELASTICITY QUESTION AND ANSWER SERIES

1. Ch 2, Problem 2.1

The demand for beer in Japan is given by the following equation: $Q^d = 700 - 2P - P_N + 0.1I$, where P is the price of beer, P_N is the price of nuts, and I is average consumer income.

- a) What happens to the demand for beer when the price of nuts goes up? Are beer and nuts demand substitutes or demand complements?

The sign in front of the price of nuts, P_N , is negative. This means when the price of nuts goes up, the beer quantity demanded falls for all levels of price (demand shifts left). Beer and nuts are demand complements.

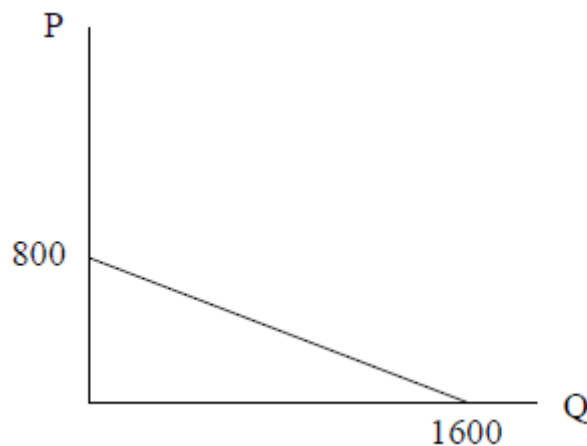
- b) What happens to the demand for beer when average consumer income rises?

The sign in front of income, I , is positive. This means when income rises, quantity demanded increases for all levels of price (demand shifts rightward).

- c) Graph the demand curve for beer when $P_N = 100$ and $I = 10,000$.

Now: $Q^d = 700 - 2P - 100 + 0.1 \cdot 10,000 = 1,600 - 2P \Rightarrow P = 800 - 0.5 Q^d$

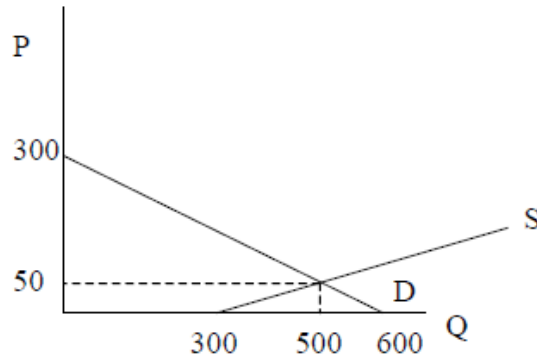
So when Q^d or Q is zero $P=800$, When $P=0$, Q^d or Q is 1600.



2. Ch 2, Problem 2.3

The demand and supply curves for coffee are given by $Q^d = 600 - 2P$ and $Q^s = 300 + 4P$.

- a) Plot the supply and demand curves on a graph and show where the equilibrium occurs.



- b) Using algebra, determine the market equilibrium price and quantity of coffee. Indicate the equilibrium price and quantity on the graph in part a.

$$600 - 2P = 300 + 4P$$

$$300 = 6P$$

$$50 = P$$

Plugging $P = 50$ back into either the supply or demand equation yields $Q = 500$.

3. Ch 2, Problem 2.13

Consider a linear demand curve, $Q = 350 - 7P$.

- a) Derive the inverse demand curve corresponding to this demand curve.

$$Q = 350 - 7P$$

$$7P = 350 - Q$$

$$P = 50 - \frac{1}{7}Q$$

- b) What is the choke price?

The choke price occurs at the point where $Q = 0$. Setting $Q = 0$ in the inverse demand equation above yields $P = 50$.

c) What is the price elasticity of demand at $P = 50$?

a. At $P = 50$, the choke price, the elasticity will approach negative infinity.

4. Ch 2, Problem 2.17

Consider the following demand and supply relationships in the market for golf balls:

$$Q^d = 90 - 2P - 2T \text{ and}$$

$$Q^s = -9 + 5P - 2.5R,$$

where T is the price of titanium, a metal used to make golf clubs, and R is the price of rubber.

a) If $R = 2$ and $T = 10$, calculate the equilibrium price and quantity of golf balls.

Substituting the values of R and T , we get

$$\text{Demand: } Q^d = 70 - 2P$$

$$\text{Supply: } Q^s = -14 + 5P$$

In equilibrium, $70 - 2P = -14 + 5P$, which implies that $P = 12$. Substituting this value back, $Q = 46$.

b) At the equilibrium values, calculate the price elasticity of demand and the price elasticity of supply.

$$\text{Elasticity of Demand} = \frac{\partial Q^d}{\partial P} * \frac{P}{Q} = -2 * \frac{12}{46} = -0.52$$

$$\text{Elasticity of Supply} = \frac{\partial Q^s}{\partial P} * \frac{P}{Q} = 5 * \frac{12}{46} = 1.30$$

c) At the equilibrium values, calculate the cross-price elasticity of demand for golf balls with respect to the price of titanium. What does the sign of this elasticity tell you about whether golf balls and titanium are substitutes or complements?

$\epsilon_{golf, titanium} = -2\left(\frac{10}{46}\right) = -0.43$. The negative sign indicates that titanium and golf balls are complements, i.e., when the price of titanium goes up the demand for golf balls decreases.

d)

5. Suppose there are only two goods (X and Y) and only two individuals (numbered 1 and 2) in an economy. Let P_X be the price of good X and P_Y be the price of good Y . And finally, let I_1 represent the income of individual 1 and I_2 the income of individual 2.

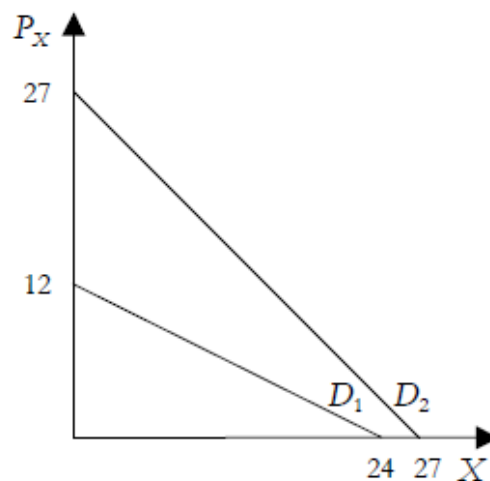
Suppose the quantity of good X demanded by individual 1 is given by

$$X_1 = 10 - 2P_X + 0.01I_1 + 0.4P_Y,$$

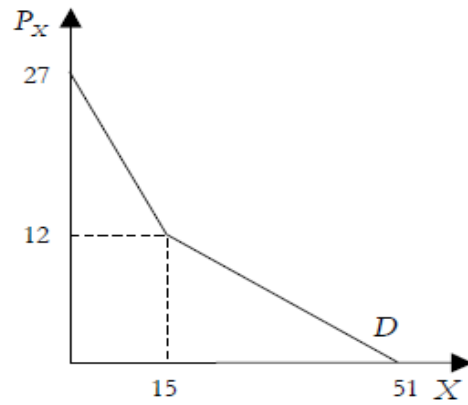
and the quantity of X demanded by individual 2 is

$$X_2 = 5 - P_X + 0.02I_2 + 0.2P_Y.$$

a. Graph the two individual demand curves (with X on the horizontal axis and P_X on the vertical axis) for the case $I_1 = 1000$, $I_2 = 1000$, and $P_Y = 10$.



b. Using the individual demand curves obtained in part b, graph the market demand curve for total X . What is the algebraic equation for this curve?



The algebraic equation for this curve was derived in part a: after plugging in $I_1 = 1000$, $I_2 = 1000$, and $P_Y = 10$, we obtain

$$X = \begin{cases} 51 - 3P_x & \text{if } 0 \leq P_x \leq 12 \\ 27 - P_x & \text{if } 12 < P_x \leq 27 \\ 0 & \text{if } P_x > 27 \end{cases}$$

6. Suppose the demand for lychees is given by the following equation:

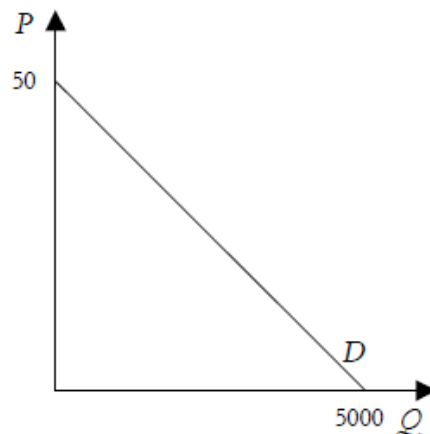
$$Q^d = 4000 - 100P + 500P_M,$$

where P is the price of lychees and P_M is the price of mangoes.

- a. What happens to the demand for lychees when the price of mangoes goes up? Are lychees and mangoes substitutes or complements?

The demand for lychees increases when the price of mangoes goes up. Therefore, lychees and mangoes are substitutes.

- b. Graph the demand curve for lychees when $P_M = 2$.

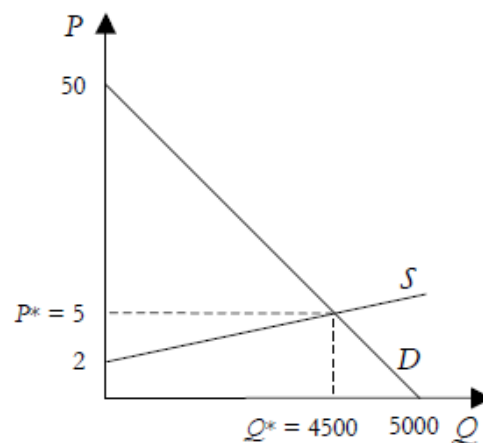


Now suppose that the quantity of lychees supplied is given by the following equation:

$$Q^s = 1500P - 60R,$$

where R is the amount of rainfall.

- c. On the same graph you drew for part b, graph the supply curve for lychees when $R = 50$. Label the equilibrium price and quantity with P^* and Q^* respectively.



- d. Calculate the equilibrium price and quantity of lychees.

Setting the quantity supplied equal to the quantity demanded, we obtain

$$\begin{aligned} Q^d &= Q^s \\ 5000 - 100P &= 1500P - 3000 \\ 8000 &= 1600P \\ P^* &= 5 \end{aligned}$$

Plugging the equilibrium price ($P^* = 5$) into the demand curve, we obtain

$$\begin{aligned} Q^d &= 5000 - 100P \\ Q^* &= 4500 \end{aligned}$$

- e. At the equilibrium values, calculate the price elasticity of demand and the price elasticity of supply. Is the demand for lychees elastic, unit elastic, or inelastic? Is the supply of lychees elastic, unit elastic, or inelastic?

The price elasticity of demand is

$$\begin{aligned}\epsilon_{Q,P} &= \frac{\partial Q^d}{\partial P} \frac{P^*}{Q^*} \\ &= -100 \left(\frac{5}{4500} \right) \\ &= -0.\bar{1}\end{aligned}$$

The demand for lychees is inelastic. The price elasticity of supply is

$$\begin{aligned}\epsilon_{Q',P} &= \frac{\partial Q^s}{\partial P} \frac{P^*}{Q^*} \\ &= 1500 \left(\frac{5}{4500} \right) \\ &= 2.\bar{6}\end{aligned}$$

The supply of lychees is elastic.

- f. At the equilibrium values, calculate the cross-price elasticity of demand for lychees with respect to the price of mangoes. What does the sign of this elasticity tell you about whether lychees and mangoes are substitutes or complements? (*Hint:* Check to make sure that your answer is consistent with your answer to part a.)

The cross-price elasticity of demand for lychees with respect to the price of mangoes is

$$\begin{aligned}\epsilon_{Q,P_M} &= \frac{\partial Q^d}{\partial P_M} \frac{P_M}{Q^*} \\ &= 500 \left(\frac{2}{4500} \right) \\ &= 0.\bar{2}\end{aligned}$$

Since the cross-price elasticity of demand is positive, the two goods are substitutes.

- g. Consider the demand curve $Q = aP^{-b}$, where a and b are positive constants. Use the formula for price elasticity of demand given in class,

$$\epsilon_{Q,P} = \frac{\partial Q}{\partial P} \frac{P}{Q},$$

to show that the price elasticity of demand is equal to $-b$ at every point on the demand curve.

We start by calculating the partial derivative of Q with respect to P :

$$\frac{\partial Q}{\partial P} = -abP^{-(b+1)}$$

Making the appropriate substitutions using $\partial Q/\partial P = -abP^{-(b+1)}$ and $Q = aP^{-b}$, we obtain

$$\begin{aligned}\epsilon_{Q,P} &= -abP^{-(b+1)} \left(\frac{P}{aP^{-b}} \right) \\ &= -abP^{-(b+1)} \left(\frac{1}{aP^{-(b+1)}} \right) \\ &= -b\end{aligned}$$

8. Ch 2, Problem 2.18

In Metropolis only taxi cab and privately owned automobiles are allowed to use the highway between the airport and downtown. The market for taxi cab service

8. Ch 2, Problem 2.18

In Metropolis only taxi cab and privately owned automobiles are allowed to use the highway between the airport and downtown. The market for taxi cab service

is competitive. There is a special lane for taxicabs, so taxis are always able to travel at 55 miles per hour. The demand for trips by taxi cabs depends on the taxi fare P , the average speed of a trip by private automobile on the highway E , and the price of gasoline G . the number of trips supplied by taxi cabs will depends on the taxi fare and the price of gasoline.

b. Suppose the demand for trips by taxi is given by the equation

$Q^d = 1000 + 50G - 4E - 400P$. The supply of trips by taxi is given by the

equation $Q^s = 200 - 30G + 100P$. On a graph draw the supply and demand curves for trips by taxi when $G=4$ and $E=30$. Find equilibrium taxi fare.

To find the equilibrium taxi fare we set $Q^d = Q^s$

$$200 - 30G + 100P = 1000 + 50G - 4E - 400P$$

$$500P = 800 + 80G - 4E$$

$$P = \frac{800 + 80G - 4E}{500} = \frac{800 + 80(4) - 4(30)}{500} = \frac{800 + 320 - 120}{500} = 2$$

- c. Solve for equilibrium taxi fare in a general case, that is, when you do not know G and E. Show how the equilibrium fare changes as G and E changes.

For part b. we figured out the general case in the 3rd line.

$$P = \frac{800 + 80G - 4E}{500}$$

We can see from this equation that that as G, the price of gasoline goes up, the equilibrium price of a taxi fare will go up. And as E, average speed of private cars goes up, the price of the trip will go down. We can get more precise measures on how exactly the price changes with respect to G and E by using calculus as shown below.

$$\frac{\partial P}{\partial G} = \frac{80}{500} = \frac{8}{50} = \frac{4}{25} = 0.16$$

$$\frac{\partial P}{\partial E} = -\frac{4}{500} = -.008$$

1) A price taker is

- A) a firm that accepts different prices from different customers.
- B) a consumer who accepts different prices from different firms.
- C) a perfectly competitive firm.
- D) a firm that cannot influence the market price.
- E) both C and D

Answer: E

Diff: 1

Section: 8.1

2) Which of following is an example of a homogeneous product?

- A) Gasoline
- B) Copper
- C) Personal computers
- D) Winter parkas
- E) both A and B

Answer: E

Diff: 1

Section: 8.1

3) Which of following is a key assumption of a perfectly competitive market?

- A) Firms can influence market price.
- B) Commodities have few sellers.
- C) It is difficult for new sellers to enter the market.
- D) Each seller has a very small share of the market.

E) none of the above

Answer: D

Diff: 1

Section: 8.1

4) Several years ago, Alcoa was effectively the sole seller of aluminum because the firm owned nearly all of the aluminum ore reserves in the world. This market was not perfectly competitive because this situation violated the:

A) price-taking assumption.

B) homogeneous product assumption.

C) free entry assumption.

D) A and B are correct.

E) A and C are correct.

Answer: E

Diff: 2

Section: 8.1

5) Use the following statements to answer this question:

- I. Markets that have only a few sellers cannot be highly competitive.
- II. Markets with many sellers are always perfectly competitive.

- A) I and II are true.
- B) I is true and II is false.
- C) II is true and I is false.
- D) I and II are false.

Answer: D

Diff: 1

Section: 8.1

6) Firms often use patent rights as a:

- A) barrier to exit.
- B) barrier to entry.
- C) way to achieve perfect competition.
- D) none of the above

Answer: A

Diff: 2

Section: 8.1

7) A few sellers may behave if they operate in a perfectly competitive market is the market demand is:

- A) highly inelastic.
- B) very elastic.
- C) unitary elastic.
- D) composed of many small buyers.

Answer: B

Diff: 2

Section: 8.1

8) If managers do not choose to maximize profit, but pursue some other goal such as revenue maximization or growth,

- A) they are more likely to become takeover targets of profit-maximizing firms.
- B) they are less likely to be replaced by stockholders.
- C) they are less likely to be replaced by the board of directors.
- D) they are more likely to have higher profit than if they had pursued that policy explicitly.
- E) their companies are more likely to survive in the long run.

Answer: A

Diff: 1

Section: 8.2

9) Owners and managers

A) must be the same people.

B) may be different people with different goals, and in the long run firms that do best are those in which the managers are allowed to pursue their own independent goals.

C) may be different people with different goals, but in the long run firms that do best are those in which the managers pursue the goals of the owners.

D) may be different people with different but exactly complementary goals.

E) may be different people with the same goals.

Answer: C

Diff: 1

Section: 8.2

10) The textbook for your class was not produced in a perfectly competitive industry because

A) there are so few firms in the industry that market shares are not small, and firms' decisions have an impact on market price.

B) upper-division microeconomics texts are not all alike.

C) it is not costless to enter or exit the textbook industry.

D) of all of the above reasons.

Answer: D

Diff: 2

Section: 8.2

11) If any of the assumptions of perfect competition are violated,

A) supply-and-demand analysis cannot be used to study the industry.

B) graphs with flat demand curves cannot be used to study the firm.

C) graphs with downward-sloping demand curves cannot be used to study the firm.

D) there may still be enough competition in the industry to make the model of perfect competition usable.

E) one must use the monopoly model instead.

Answer: D

Diff: 2

Section: 8.2

12) The "perfect information" assumption of perfect competition includes all of the following except one. Which one?

A) Consumers know their preferences.

B) Consumers know their income levels.

C) Consumers know the prices available.

D) Consumers can anticipate price changes.

E) Firms know their costs, prices and technology.

Answer: D

Diff: 2

Section: 8.2

13) The authors note that the goal of maximizing the market value of the firm may be more appropriate than maximizing short-run profits because:

- A) the market value of the firm is based on long-run profits.
- B) managers will not focus on increasing short-run profits at the expense of long-run profits.
- C) this would more closely align the interests of owners and managers.
- D) all of the above

Answer: D

Diff: 2

Section: 8.2

14) An association of businesses that are jointly owned and operated by members for mutual benefit is a:

- A) condominium.
- B) corporation.
- C) cooperative.
- D) joint tenancy.

Answer: C

Diff: 1

Section: 8.2

15) In many rural areas, electric generation and distribution utilities were initially set up as cooperatives in which the electricity customers were member-owners. Like most cooperatives, the objective of these firms was to:

- A) maximize profits for the member-owners.
- B) maximize total revenue that could be redistributed to the member-owners.
- C) operate at zero profit in order to provide low electricity prices for the member-owners.
- D) minimize the costs of production.

Answer: C

Diff: 2

Section: 8.2

16) Revenue is equal to

- A) price times quantity.
- B) price times quantity minus total cost.
- C) price times quantity minus average cost.
- D) price times quantity minus marginal cost.
- E) expenditure on production of output.

Answer: A

Diff: 1

Section: 8.3

17) Marginal revenue, graphically, is

- A) the slope of a line from the origin to a point on the total revenue curve.
- B) the slope of a line from the origin to the end of the total revenue curve.
- C) the slope of the total revenue curve at a given point.
- D) the vertical intercept of a line tangent to the total revenue curve at a given point.
- E) the horizontal intercept of a line tangent to the total revenue curve at a given point.

Answer: C

Diff: 1

Section: 8.3

18) A firm maximizes profit by operating at the level of output where

- A) average revenue equals average cost.
- B) average revenue equals average variable cost.
- C) total costs are minimized.
- D) marginal revenue equals marginal cost.
- E) marginal revenue exceeds marginal cost by the greatest amount.

Answer: D

Diff: 1

Section: 8.3

19) At the profit-maximizing level of output, what is true of the total revenue (TR) and total cost (TC) curves?

- A) They must intersect, with TC cutting TR from below.
- B) They must intersect, with TC cutting TR from above.
- C) They must be tangent to each other.
- D) They cannot be tangent to each other.
- E) They must have the same slope.

Answer: E

Diff: 1

Section: 8.3

20) When the TR and TC curves have the same slope,

- A) they are the furthest from each other.
- B) they are closest to each other.
- C) they intersect each other.
- D) profit is negative.
- E) profit is zero.

Answer: A

Diff: 1

Section: 8.3

21) If current output is less than the profit-maximizing output, then the next unit produced

- A) will decrease profit.
- B) will increase cost more than it increases revenue.
- C) will increase revenue more than it increases cost.
- D) will increase revenue without increasing cost.
- E) may or may not increase profit.

Answer: C

Diff: 1

Section: 8.3

22) If current output is less than the profit-maximizing output, which must be true?

- A) Total revenue is less than total cost.
- B) Average revenue is less than average cost.
- C) Average revenue is greater than average cost.
- D) Marginal revenue is less than marginal cost.
- E) Marginal revenue is greater than marginal cost.

Answer: E

Diff: 1

Section: 8.3

23) Marginal profit is equal to

- A) marginal revenue minus marginal cost.
- B) marginal revenue plus marginal cost.
- C) marginal cost minus marginal revenue.
- D) marginal revenue times marginal cost.
- E) marginal revenue divided by marginal cost.

Answer: A

Diff: 1

Section: 8.3

24) At the profit-maximizing level of output, marginal profit

- A) is also maximized.
- B) is zero.
- C) is positive.
- D) is increasing.
- E) may be positive, negative or zero.

Answer: B

Diff: 1

Section: 8.3

25) The demand curve facing a perfectly competitive firm is

- A) the same as the market demand curve.
- B) downward-sloping and less flat than the market demand curve.
- C) downward-sloping and more flat than the market demand curve.
- D) perfectly horizontal.
- E) perfectly vertical.

Answer: D

Diff: 1

Section: 8.3

26) The demand curve facing a perfectly competitive firm is

- A) the same as its average revenue curve, but not the same as its marginal revenue curve.
- B) the same as its average revenue curve and its marginal revenue curve.

- C) the same as its marginal revenue curve, but not its average revenue curve.
- D) not the same as either its marginal revenue curve or its average revenue curve.
- E) not defined in terms of average or marginal revenue.

Answer: B

Diff: 1

Section: 8.3

27) The perfectly competitive firm's marginal revenue curve is

- A) exactly the same as the marginal cost curve.
- B) downward-sloping, at twice the (negative) slope of the market demand curve.
- C) vertical.
- D) horizontal.
- E) upward-sloping.

Answer: D

Diff: 1

Section: 8.3

28) Because of the relationship between a perfectly competitive firm's demand curve and its marginal revenue curve, the profit maximization condition for the firm can be written as

- A) $P = MR$.
- B) $P = AVC$.
- C) $AR = MR$.
- D) $P = MC$.
- E) $P = AC$.

Answer: D

Diff: 1

Section: 8.3

29) The amount of output that a firm decides to sell has no effect on the market price in a competitive industry because

- A) the market price is determined (through regulation) by the government
- B) the firm supplies a different good than its rivals
- C) the firm's output is a small fraction of the entire industry's output
- D) the short run market price is determined solely by the firm's technology
- E) the demand curve for the industry's output is downward sloping

Answer: C

Diff: 1

Section: 8.3

- 30) If the market price for a competitive firm's output doubles then
- A) the profit maximizing output will double
 - B) the marginal revenue doubles
 - C) at the new profit maximizing output, price has increased more than marginal cost
 - D) at the new profit maximizing output, price has risen more than marginal revenue
 - E) competitive firms will earn an economic profit in the long-run.

Answer: B

Diff: 1

Section: 8.3

- 31) Marginal profit is negative when:
- A) marginal revenue is negative.
 - B) total cost exceeds total revenue.
 - C) output exceeds the profit-maximizing level.
 - D) profit is negative.

Answer: C

Diff: 2

Section: 8.3

- 32) Suppose the state legislature in your state imposes a state licensing fee of \$100 per year to be paid by all firms that file state tax revenue reports. This new business tax:

- A) increases marginal cost.
- B) decreases marginal cost.
- C) increases marginal revenue.
- D) decreases marginal revenue.
- E) none of the above

Answer: E

Diff: 2

Section: 8.3

Consider the following diagram where a perfectly competitive firm faces a price of \$40.

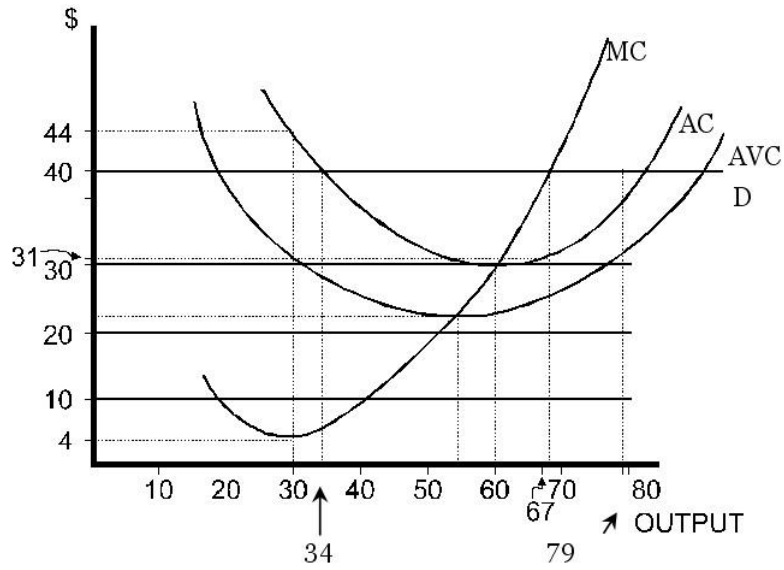


Figure 8.1

33) Refer to Figure 8.1. The profit-maximizing output is

- A) 30.
- B) 54.
- C) 60.
- D) 67.
- E) 79.

Answer: D

Diff: 1

Section: 8.4

34) Refer to Figure 8.1. The firm earns zero profit at what output?

- A) 0.
- B) 34 and 79.
- C) 54.
- D) 60.
- E) 67.

Answer: B

Diff: 1

Section: 8.4

35) Refer to Figure 8.1. At 67 units of output, profit is

- A) maximized and zero.
- B) maximized and negative.
- C) maximized and positive.
- D) not maximized, and zero.
- E) not maximized, and negative.

Answer: C

Diff: 1

Section: 8.4

36) Refer to Figure 8.1. At the profit-maximizing level of output, ATC is

- A) \$26.
- B) \$30.
- C) \$31.
- D) \$40.
- E) \$44.

Answer: C

Diff: 1

Section: 8.4

37) Refer to Figure 8.1. At the profit-maximizing level of output, AVC is

- A) \$22.
- B) \$26.
- C) \$30.
- D) \$32.
- E) \$40.

Answer: B

Diff: 1

Section: 8.4

38) Refer to Figure 8.1. At the profit-maximizing level of output,

- A) AVC is minimized.
- B) ATC is minimized.
- C) MC is minimized.
- D) total cost is minimized.
- E) no costs are minimized.

Answer: E

Diff: 1

Section: 8.4

39) Refer to Figure 8.1. At the profit-maximizing level of output, total revenue is

- A) \$1200.
- B) \$2160.
- C) \$2400.
- D) \$2680.
- E) \$3160.

Answer: D

Diff: 1

Section: 8.4

40) Refer to Figure 8.1. At the profit-maximizing level of output, total profit is

- A) -\$120.
- B) \$0.

C) \$432.

D) \$600.

E) \$603.

Answer: E

Diff: 1

Section: 8.4

41) If a graph of a perfectly competitive firm shows that the $MR = MC$ point occurs where MR is above AVC but below ATC ,

A) the firm is earning negative profit, and will shut down rather than produce that level of output.

B) the firm is earning negative profit, but will continue to produce where $MR = MC$ in the short run.

C) the firm is still earning positive profit, as long as variable costs are covered.

D) the firm is covering explicit, but not implicit, costs.

E) the firm can cover all of fixed costs but only a portion of variable costs.

Answer: B

Diff: 2

Section: 8.4

42) Bette's Breakfast, a perfectly competitive eatery, sells its "Breakfast Special" (the only item on the menu) for \$5.00. The costs of waiters, cooks, power, food etc. average out to \$3.95 per meal; the costs of the lease, insurance and other such expenses average out to \$1.25 per meal. Bette should

A) close her doors immediately.

B) continue producing in the short and long run.

C) continue producing in the short run, but plan to go out of business in the long run.

D) raise her prices above the perfectly competitive level.

E) lower her output.

Answer: C

Diff: 2

Section: 8.4

43) If price is between AVC and ATC , the best and most practical thing for a perfectly competitive firm to do is

A) raise prices.

B) lower prices to gain revenue from extra volume.

C) shut down immediately, but not liquidate the business.

D) shut down immediately and liquidate the business.

E) continue operating, but plan to go out of business.

Answer: E

Diff: 2

Section: 8.4

- 44) An improvement in technology would result in
- A) upward shifts of MC and reductions in output.
 - B) upward shifts of MC and increases in output.
 - C) downward shifts of MC and reductions in output.
 - D) downward shifts of MC and increases in output.
 - E) increased quality of the good, but little change in MC.

Answer: D

Diff: 1

Section: 8.4

- 45) If a competitive firm has a U-shaped marginal cost curve then
- A) the profit maximizing output will always generate positive economic profit.
 - B) the profit maximizing output will always generate positive producer surplus.
 - C) the profit maximizing output is found where $MC = MR$ and MC is decreasing.
 - D) the profit maximizing output is found where $MC = MR$ and MC is constant.
 - E) the profit maximizing output is found where $MC = MR$ and MC is increasing.

Answer: E

Diff: 2

Section: 8.4

Table 8.1

Q	P	TR	MR	TC	MC
0	\$30	\$0	---	\$15	---
1	\$30	\$30	\$30	\$25	\$10
2	\$30	\$60	\$30	\$40	\$15
3	\$30	\$90	\$30	\$60	\$20
4	\$30	\$120	\$30	\$85	\$25
5	\$30	\$150	\$30	\$115	\$30
6	\$30	\$180	\$30	\$150	\$35

- 46) Refer to Table 8.1. That the firm is perfectly competitive is evident from its
- A) increasing marginal cost.
 - B) increasing total cost.
 - C) zero economic profits.
 - D) constant marginal revenue.
 - E) absence of marginal values at $Q = 0$.

Answer: D

Diff: 2

Section: 8.4

47) Refer to Table 8.1. The maximum profit available to the firm is

- A) \$20.
- B) \$30.
- C) \$35.
- D) \$155.
- E) \$180.

Answer: C

Diff: 1

Section: 8.4

48) Average cost for the firm in Table 8.1

- A) cannot be determined from the information given.
- B) is upward-sloping for all output values shown.
- C) is constant for all output values shown.
- D) is downward-sloping for all output values shown.
- E) is U-shaped.

Answer: E

Diff: 1

Section: 8.4

49) That Table 8.1 shows a short-run situation is evident from

- A) the linear marginal revenue function.
- B) the constant price.
- C) the increasing marginal cost.
- D) the presence of positive costs at $Q = 0$.
- E) the absence of marginal values at $Q = 0$.

Answer: D

Diff: 1

Section: 8.4

50) The total revenue graph consistent with Table 8.1 is

- A) linear and upward-sloping.
- B) linear and horizontal.
- C) linear and vertical.
- D) linear and downward-sloping.
- E) concave downwards.

Answer: A

Diff: 1

Section: 8.4

51) In the short run, a perfectly competitive firm earning positive economic profit is

- A) on the downward-sloping portion of its ATC.
- B) at the minimum of its ATC.
- C) on the upward-sloping portion of its ATC.
- D) above its ATC.
- E) below its ATC.

Answer: C

Diff: 1

Section: 8.4

52) If a competitive firm's marginal cost curve is U-shaped then

- A) its short run supply curve is U-shaped too
- B) its short run supply curve is the downward-sloping portion of the marginal cost curve

- C) its short run supply curve is the upward-sloping portion of the marginal cost curve
- D) its short run supply curve is the upward-sloping portion of the marginal cost curve that lies above the short run average variable cost curve
- E) its short run supply curve is the upward-sloping portion of the marginal cost curve that lies above the short run average total cost curve

Answer: D

Diff: 2

Section: 8.4

53) In the short run, a perfectly competitive profit maximizing firm that has not shut down

- A) is operating on the downward-sloping portion of its AVC curve.
- B) is operating at the minimum of its AVC curve.
- C) is operating on the upward-sloping portion of its AVC curve.
- D) is not operating on its AVC curve.
- E) can be at any point on its AVC curve.

Answer: C

Diff: 3

Section: 8.4

54) In the short run, a perfectly competitive firm earning negative economic profit is

- A) on the downward-sloping portion of its ATC curve.
- B) at the minimum of its ATC curve.
- C) on the upward-sloping portion of its ATC curve.
- D) above its ATC curve.

Answer: A

Diff: 3

Section: 8.4

55) In the short run, a perfectly competitive firm earning negative economic profit

- A) is on the downward-sloping portion of its AVC.
- B) is at the minimum of its AVC.
- C) is on the upward-sloping portion of its AVC.
- D) is not operating on its AVC.
- E) can be at any point on its AVC.

Answer: C

Diff: 3

Section: 8.4

- 56) A firm never operates
- A) at the minimum of its ATC curve.
 - B) at the minimum of its AVC curve.
 - C) on the downward-sloping portion of its ATC curve.
 - D) on the downward-sloping portion of its AVC curve.
 - E) on its long-run marginal cost curve.

Answer: D

Diff: 3

Section: 8.4

- 57) When the price faced by a competitive firm was \$5, the firm produced nothing in the short run. However, when the price rose to \$10, the firm produced 100 tons of output. From this we can infer that
- A) the firm's marginal cost curve must be flat.
 - B) the firm's marginal costs of production never fall below \$5.
 - C) the firm's average cost of production was less than \$10.
 - D) the firm's total cost of producing 100 tons is less than \$1000.
 - E) the minimum value of the firm's average variable cost lies between \$5 and \$10.

Answer: E

Diff: 3

Section: 8.4

- 58) An industry analyst observes that in response to a small increase in price, a competitive firm's output sometimes rises a little and sometimes a lot. The best explanation for this finding is that
- A) the firm's marginal cost curve is random.
 - B) the firm's marginal cost curve has a very small positive slope.
 - C) the firm's marginal cost has a very large positive slope.
 - D) the firm's marginal cost curve is horizontal for some ranges of output and rises in steps.
 - E) the firm's marginal cost curve is downward sloping.

Answer: D

Diff: 3

Section: 8.4

Scenario 8.1:

Two soft-drink firms, Fizzle & Sizzle, operate on a river. Fizzle is farther upstream, and gets cleaner water, so its cost of purifying water for use in the soft drinks is lower than Sizzle's by \$500,000 yearly.

- 59) According to Scenario 8.1, Fizzle and Sizzle
- A) would be perfectly competitive if their purification costs were equal; otherwise, not.
 - B) would be perfectly competitive if it costs Fizzle \$500,000 yearly to keep that land.
 - C) may or may not be perfect competitors, but their position on the river has nothing to do with it.
 - D) cannot be perfect competitors because they are not identical firms.

Answer: C

Diff: 2

Section: 8.4

- 60) Refer to the information in Scenario 8.1. If Fizzle and Sizzle sell the same output at the same price and are otherwise identical, Fizzle's profit will be
- A) higher than Sizzle's by \$500,000 yearly.
 - B) higher than Sizzle's by just less than \$500,000 yearly.
 - C) zero in the long run, and Sizzle will be out of business.
 - D) the same as Sizzle's, because Fizzle must be assigned an implicit cost of \$500,000 yearly for economic rent.
 - E) the same as Sizzle's, because Sizzle will move to a more advantageous location in order to compete.

Answer: D
Diff: 3
Section: 8.4

61) Suppose your firm has a U-shaped average variable cost curve and operates in a perfectly competitive market. If you produce where the product price (marginal revenue) equals average variable cost (on the upward sloping portion of the AVC curve), then your output will:

- A) exceed the profit-maximizing level of output.
- B) be smaller than the profit-maximizing level of output.
- C) equal the profit-maximizing level of output.
- D) generate zero economic profits.

Answer: A
Diff: 3
Section: 8.4

62) Use the following statements to answer this question:

I. The firm's decision to produce zero output when the price is less than the average variable cost of production is known as the shutdown rule.

II. The firm's supply decision is to generate zero output for all prices below the minimum AVC.

- A) I and II are true.
- B) I is true and II is false.
- C) II is true and I is false.
- D) I and II are false.

Answer: A
Diff: 1
Section: 8.4

63) The supply curve for a competitive firm is

- A) its entire MC curve.
- B) the upward-sloping portion of its MC curve.
- C) its MC curve above the minimum point of the AVC curve.
- D) its MC curve above the minimum point of the ATC curve.
- E) its MR curve.

Answer: C
Diff: 1
Section: 8.5

- 64) Higher input prices result in
- A) upward shifts of MC and reductions in output.
 - B) upward shifts of MC and increases in output.
 - C) downward shifts of MC and reductions in output.
 - D) downward shifts of MC and increases in output.
 - E) increased demand for the good the input is used for.

Answer: A

Diff: 1

Section: 8.5

65) Suppose a technological innovation shifts the marginal cost curve downward. Which one of the following cost curves does NOT shift?

- A) Firm's short-run supply curve
- B) Average total cost curve
- C) Average variable cost curve
- D) Average fixed cost curve

Answer: D

Diff: 1

Section: 8.5

66) Short-run supply curves for perfectly competitive firms tend to be upward sloping because:

- A) there is diminishing marginal product for one or more variable inputs.
- B) marginal costs increase as output increases.
- C) marginal fixed costs equal zero.
- D) A and B are correct.
- E) B and C are correct.

Answer: D

Diff: 2

Section: 8.5

67) Use the following statements to answer this question:

- I. Under perfect competition, an upward shift in the marginal cost curve (perhaps due to a higher price for a variable input) also shifts the average variable cost curve upward.
- II. Under perfect competition, an upward shift in the marginal cost curve (perhaps due to a higher price for a variable input) reduces firm output but may increase firm profits.

- A) I and II are true.
- B) I is true and II is false.
- C) II is true and I is false.
- D) I and II are false.

Answer: B

Diff: 3

Section: 8.5

68) Producer surplus in a perfectly competitive industry is

- A) the difference between profit at the profit-maximizing output and profit at the profit-minimizing output.
- B) the difference between revenue and total cost.
- C) the difference between revenue and variable cost.
- D) the difference between revenue and fixed cost.
- E) the same thing as revenue.

Answer: C

Diff: 1

Section: 8.6

69) The shutdown decision can be restated in terms of producer surplus by saying that a firm should produce in the short run as long as

- A) revenue exceeds producer surplus.
- B) producer surplus is positive.
- C) producer surplus exceeds fixed cost.
- D) producer surplus exceeds variable cost.
- E) profit and producer surplus are equal.

Answer: B

Diff: 1

Section: 8.6

70) A firm's producer surplus equals its economic profit when

- A) average variable costs are minimized.
- B) average fixed costs are minimized.
- C) marginal costs equal marginal revenue.
- D) fixed costs are zero.
- E) total revenues equal total variable costs.

Answer: D

Diff: 1

Section: 8.6

71) In a supply-and-demand graph, producer surplus can be pictured as the

- A) vertical intercept of the supply curve.
- B) area between the demand curve and the supply curve to the left of equilibrium output.
- C) area under the supply curve to the left of equilibrium output.
- D) area under the demand curve to the left of equilibrium output.
- E) area between the equilibrium price line and the supply curve to the left of equilibrium output.

Answer: E

Diff: 2

Section: 8.6

72) If a competitive firm's marginal costs always increase with output, then at the profit maximizing output level, producer surplus is

- A) zero because marginal costs equal marginal revenue.
- B) zero because price equals marginal costs.
- C) positive because price exceeds average variable costs.
- D) positive because price exceeds average total costs.
- E) positive because revenues are increasing faster than variable costs.

Answer: C

Diff: 3

Section: 8.6

73) Three hundred firms supply the market for paint. For fifty of the firms, their short-run average variable costs are minimized at \$10 and short-run total costs are minimized at \$15. For the remaining firms, the short-run average variable costs and short-run average total costs are minimized at \$20 and \$25, respectively. If each firm has a U-shaped marginal cost curve then the short-run market supply curve is

- A) U-shaped too
- B) kinked at \$10
- C) kinked at \$15
- D) kinked at \$20
- E) kinked at \$25

Answer: D

Diff: 3

Section: 8.6

74) An industry has 1000 competitive firms, each producing 50 tons of output. At the current market price of \$10, half of the firms have a short-run supply curve with a slope of 1; the other half each have a short-run supply curve with slope 2. The short-run elasticity of market supply is

- A) $1/50$
- B) $3/10$
- C) $1/5$
- D) $2/5$
- E) none of the above

Answer: B

Diff: 3

Section: 8.6

75) Imposition of an output tax on all firms in a competitive industry will result in

- A) a downward shift in each firm's marginal cost curve.
- B) a downward shift in each firm's average cost curve.
- C) a leftward shift in the market supply curve.
- D) the entry of new firms into the industry.
- E) higher profits for the industry as price rises.

Answer: C

Diff: 1

Section: 8.6

76) Suppose all firms have constant marginal costs that are the same for each firm in the short run. In this case, the market level supply curve is _____ and producer surplus equals _____:

- A) perfectly inelastic, fixed costs
- B) perfectly inelastic, zero
- C) perfectly elastic, fixed costs
- D) perfectly elastic, zero

Answer: D

Diff: 2

Section: 8.6

77) One practical implication of a kinked market supply curve is that:

- A) producer surplus is not defined at the kink point.
- B) the $MC = MR$ rule does not hold at the kink point.
- C) the market supply elasticity for a price increase may be different than the market supply elasticity for a price decrease at the kink point.
- D) All of the above are true.

Answer: C

Diff: 2

Section: 8.6

78) In the long run, a firm's producer surplus is equal to the

- A) economic rent it enjoys from its scarce inputs.
- B) revenue it earns in the long run.
- C) positive economic profit it earns in the long run.
- D) difference between total revenue and total variable costs.
- E) difference between total revenue and total fixed costs.

Answer: A

Diff: 3

Section: 8.7

79) Consider the following statements when answering this question

- I. If the cost of producing each unit of output falls \$5, then the short-run market price falls \$5.
- II. If the cost of producing each unit of output falls \$5, then the long-run market price falls \$5.

- A) I and II are true.
- B) I is true, and II is false.
- C) I is false, and II is true.
- D) I and II are false.

Answer: C

Diff: 3

Section: 8.7

80) Consider the following statements when answering this question

I. Increases in the demand for a good, which is produced by a competitive industry, will raise the short-run market price.

II. Increases in the demand for a good, which is produced by a competitive industry will raise the long-run market price.

A) I and II are true.

B) I is true, and II is false.

C) I is false, and II is true.

D) I and II are false.

Answer: B

Diff: 3

Section: 8.7

81) Consider the following statements when answering this question

I. In the long run, if a firm wants to remain in a competitive industry, then it needs to own resources that are in limited supply."

II. In this competitive market our firm's long run survival depends only on the efficiency of our production process.

A) I and II are true.

B) I is true, and II is false.

C) I is false, and II is true.

D) I and II are false.

Answer: C

Diff: 3

Section: 8.7

82) Consider the following statements when answering this question

I. In the long-run equilibrium of a perfectly competitive market, a firm's producer surplus equals the sum of the economic rents earned on its inputs to production.

II. In the long-run equilibrium of a perfectly competitive market, the amount of economic profit earned can differ across firms, but not the amount of producer surplus.

A) I and II are true.

B) I is true, and II is false.

C) I is false, and II is true.

D) I and II are false.

Answer: B

Diff: 3

Section: 8.7

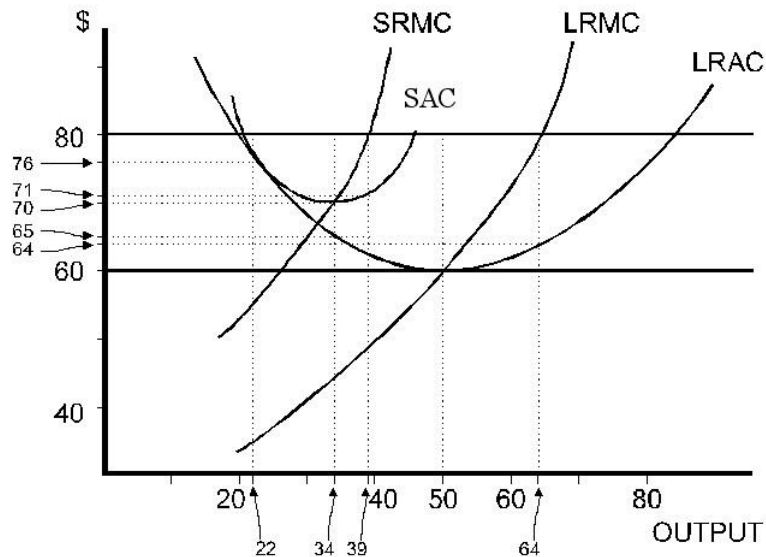


Figure 8.2

83) Refer to Figure 8.2. At $P = \$80$, the profit-maximizing output in the short run is

- A) 22.
- B) 34.
- C) 39.
- D) 50.
- E) 64.

Answer: C

Diff: 1

Section: 8.7

84) Refer to Figure 8.2. At $P = \$80$, how much is profit in the short run?

- A) \$88
- B) \$306
- C) \$351
- D) \$1000
- E) \$1024

Answer: C

Diff: 1

Section: 8.7

85) Refer to Figure 8.2. If the firm expects \$80 to be the long-run price, how many units of output will it plan to produce in the long run?

- A) 22
- B) 34
- C) 38
- D) 50
- E) 64

Answer: E

Diff: 1

Section: 8.7

86) Refer to Figure 8.2. How much profit will the firm earn if price stays at \$80?

- A) \$0
- B) \$306

C) \$312
D) \$1000
E) \$1024
Answer: E
Diff: 1
Section: 8.7

87) Refer to Figure 8.2. As the firm makes its long-run adjustment, which must be true?

- A) It takes advantage of increasing returns to scale.
- B) It suffers from decreasing returns to scale.
- C) It takes advantage of increasing marginal product.
- D) It takes advantage of economies of scale.
- E) It takes advantage of diseconomies of scale.

Answer: D
Diff: 1
Section: 8.7

88) Refer to Figure 8.2. As the competitive industry, not just the firm in question, moves toward long-run equilibrium, the firm will be forced to operate at what level of output?

- A) 22
- B) 34
- C) 38.
- D) 50
- E) 64

Answer: D
Diff: 1
Section: 8.7

89) Refer to Figure 8.2. As the competitive industry, not just the firm in question, moves toward long-run equilibrium, what will the price be?

- A) \$60
- B) \$64
- C) \$70
- D) \$71
- E) \$80

Answer: A
Diff: 1
Section: 8.7

90) Refer to Figure 8.2. As the competitive industry, not just the firm in question, moves toward long-run equilibrium, how much profit will the firm earn?

- A) \$0
- B) \$306
- C) \$312
- D) \$1000.
- E) \$1024

Answer: A

Diff: 1

Section: 8.7

91) In long-run competitive equilibrium, a firm that owns factors of production will have an

- A) economic profit = \$0 and accounting profit > \$0.
- B) economic profit > \$0 and accounting profit = \$0.
- C) economic and accounting profit = \$0.
- D) economic and accounting profit > \$0.
- E) economic and accounting profit can take any value.

Answer: A

Diff: 3

Section: 8.7

92) What happens in a perfectly competitive industry when economic profit is greater than zero?

- A) Existing firms may get larger.
- B) New firms may enter the industry.
- C) Firms may move along their LRAC curves to new outputs.
- D) There may be pressure on prices to fall.
- E) All of the above may occur.

Answer: E

Diff: 3

Section: 8.7

93) Which of the following is NOT a necessary condition for long-run equilibrium under perfect competition?

- A) No firm has an incentive to enter the market.
- B) No firm has an incentive to exit the market.
- C) Prices are relatively low.
- D) Each firm earns zero economic profit.
- E) Each firm is maximizing profit.

Answer: C

Diff: 2

Section: 8.7

94) Although the long-run equilibrium price of oil is \$80 per barrel, some producers have much lower costs because their oil reserves are relatively close to the surface and are easier to extract. If the low-cost producers have a minimum LAC equal to \$20 per barrel, then the difference (\$60 per barrel) is:

- A) an above-normal economic profit.
- B) an economic rent due to the scarcity of low-cost oil reserves.
- C) a profit that will go to zero as new oil producers enter the market.
- D) none of the above

Answer: B

Diff: 2

Section: 8.7

95) Economic rents are typically counted as:

- A) accounting costs but not economic costs.
- B) accounting and economic costs.
- C) economic costs but not accounting costs.
- D) none of the above

Answer: C

Diff: 1

Section: 8.7

Scenario 8.2:

Yachts are produced by a perfectly competitive industry in Dystopia. Industry output (Q) is currently 30,000 yachts per year. The government, in an attempt to raise revenue, places a \$20,000 tax on each yacht. Demand is highly, but not perfectly, elastic.

96) Refer to Scenario 8.2. The result of the tax in the long run will be that

- A) Q falls from 30,000; P rises by less than \$20,000.
- B) Q falls from 30,000; P rises by \$20,000.
- C) Q falls from 30,000; P does not change.
- D) Q stays at 30,000; P rises by \$20,000.
- E) Q stays at 30,000; P rises by less than \$20,000.

Answer: A

Diff: 1

Section: 8.8

97) Refer to Scenario 8.2. The more elastic is demand for yachts,

- A) the more Q will fall and the more P will rise.
- B) the less Q will fall and the more P will rise.
- C) the more Q will fall and the less P will rise.
- D) the less Q will fall and the less P will rise.
- E) the closer is the new equilibrium point to the old.

Answer: C

Diff: 2

Section: 8.8

98) Generally, long-run elasticities of supply are

- A) greater than short-run elasticities, because existing inventories can be exploited during shortages.
- B) greater than short-run elasticities, because consumers have time to find substitutes for the good.
- C) greater than short-run elasticities, because firms can make alterations to plant size and input combinations to be more flexible in production.
- D) smaller than short-run elasticities, because the firm has made long-term commitments it cannot easily modify.
- E) the same as short-run elasticities, because technology is not assumed to change in the long-run adjustment process.

Answer: C

Diff: 1

Section: 8.8

99) In a constant-cost industry, an increase in demand will be followed by

- A) no increase in supply.
- B) an increase in supply that will not change price from the higher level that occurs after the demand shift.
- C) an increase in supply that will bring price down to the level it was before the demand shift.
- D) an increase in supply that will bring price down below the level it was before the demand shift.
- E) a decrease in demand to keep price constant.

Answer: C

Diff: 2

Section: 8.8

100) In a constant-cost industry, price always equals

- A) LRMC and minimum LRAC.
- B) LRMC and LRAC, but not necessarily minimum LRAC.
- C) minimum LRAC, but not LRMC.
- D) LRAC and minimum LRMC.
- E) minimum LRAC and minimum LRMC.

Answer: A

Diff: 2

Section: 8.8

101) In an increasing-cost industry, expansion of output

- A) causes input prices to rise as demand for them grows.
- B) leaves input prices constant as input demand grows.
- C) causes economies of scale to occur.
- D) occurs under conditions of increasing returns to scale.
- E) occurs without diminishing marginal product.

Answer: A

Diff: 2

Section: 8.8

102) The long-run supply curve in a constant-cost industry is linear and

- A) upward-sloping.
- B) downward-sloping.
- C) horizontal.
- D) vertical.
- E) could have any constant slope.

Answer: C

Diff: 1

Section: 8.8

103) An increasing-cost industry is so named because of the positive slope of which curve?

- A) Each firm's short-run average cost curve
- B) Each firm's short-run marginal cost curve
- C) Each firm's long-run average cost curve
- D) Each firm's long-run marginal cost curve
- E) The industry's long-run supply curve

Answer: E

Diff: 1

Section: 8.8

104) A decreasing-cost industry has a downward-sloping

- A) long-run average cost curve.
- B) long-run marginal cost curve.
- C) short-run average cost curve.
- D) short-run marginal cost curve.
- E) long-run industry supply curve.

Answer: E

Diff: 1

Section: 8.8

105) Which of the following cases are examples of industries that have potentially increasing costs due to scarce inputs?

- A) Petroleum production
- B) Medical care
- C) Legal services
- D) all of the above

Answer: D

Diff: 1

Section: 8.8

106) Which of the following events does NOT occur when market demand shifts leftward in an increasing-cost industry?

- A) Initially, the output produced by existing firms declines along the short-run market supply curve.
- B) The market price declines below the minimum LAC due to the short-run supply response.
- C) The market supply curve shifts leftward as some firms exit the market when the market price is below the minimum LAC.
- D) As firms exit, the market price rises and attracts other firms to enter the market.
- E) The LAC curve shifts downward as output falls.

Answer: D

Diff: 3

Section: 8.8

107) The following table contains information for a price taking competitive firm. Complete the table and determine the profit maximizing level of output (round your answer to the nearest whole number).

Output	Total Cost	Marginal Cost	Fixed Cost	Average Cost	Total Revenue	Average Revenue	Marginal Revenue
0	5				0		
1	7				10		
2	11				20		
3	17				30		
4	27				40		
5	41				50		
6	61				60		

Answer:

Output	Total Cost	Marginal Cost	Fixed Cost	Average Cost	Total Revenue	Average Revenue	Marginal Revenue
0	5	-	5	-	0	-	-
1	7	2	5	7	10	10	10
2	11	4	5	5.5	20	10	10
3	17	6	5	6	30	10	10
4	27	10	5	7	40	10	10
5	41	14	5	8	50	10	10
6	61	20	5	10	60	10	10

The profit maximizing level of output is either 3 or 4. Note that at $Q = 4$ the profit-maximizing condition $MR = MC$ is satisfied. Since this problem is discrete, the profit at $Q = 3$ happens to be the same as the profit at $Q = 4$, so either of these answers is correct.

Diff: 2

Section: 8.3

108) The following table contains information for a price taking competitive firm. Complete the table and determine the profit maximizing level of output (round your answer to the nearest whole number).

Output	Total Cost	Marginal Cost	Fixed Cost	Average Cost	Total Revenue	Average Revenue	Marginal Revenue
0			25				
1	35						
2				30			
3		45					
4	185						
5				57			
6		120			240		

Answer:

Output	Total Cost	Marginal Cost	Fixed Cost	Average Cost	Total Revenue	Average Revenue	Marginal Revenue
0	25	-	25	-	0	-	-
1	35	10	25	35	40	40	40
2	60	25	25	30	80	40	40
3	105	45	25	35	120	40	40
4	185	80	25	46	160	40	40
5	285	100	25	57	200	40	40
6	405	120	25	66	240	40	40

The profit maximizing level of output is 2.

Diff: 1

Section: 8.3

109) Conigan Box Company produces cardboard boxes that are sold in bundles of 1000 boxes. The market is highly competitive, with boxes currently selling for \$100 per thousand. Conigan's total and marginal cost curves are:

$$TC = 3,000,000 + 0.001Q^2$$

$$MC = 0.002Q$$

where Q is measured in thousand box bundles per year.

- Calculate Conigan's profit maximizing quantity. Is the firm earning a profit?
- Analyze Conigan's position in terms of the shutdown condition. Should Conigan operate or shut down in the short run?

Answer:

a.

Given the competitive nature of the industry, Conigan should equate P to MC.

$$100 = 0.002Q$$

$$Q = 50,000$$

To determine profit:

$$\pi = TR - TC$$

$$TR = PQ$$

$$TR = \$100 \cdot 50,000$$

$$TR = 5,000,000$$

$$TC = 3,000,000 + 0.001(50,000)^2$$

$$TC = 3,000,000 + 2,500,000$$

$$TC = 5,500,000$$

$$\pi = 5,000,000 - 5,500,000$$

$$\pi = -500$$

Conigan is losing \$500,000 per year.

b.

To determine if the firm should operate or shutdown, we must compare P to AVC.

$$AVC = \frac{TVC}{Q}$$

$$TVC = TC - TFC$$

$$TVC = 5,500,000 - 3,000,000$$

$$TVC = 2,500,000$$

$$AVC = \frac{2,500,000}{50,000} = \$50$$

$$AVC = 50; P = \$100$$

The firm should operate since $P > AVC$.

Diff: 1

Section: 8.4

110) The table below lists the short-run costs for One Guy's Pizza. If One Guy's can sell all the output they produce for \$12 per unit, how much should One Guy's produce to maximize profits? Does One Guy's Pizza earn an economic profit in the short-run?

Q	TFC	TVC	ATC	AVC	MC	Profits
58	100	336.4				
59	100	348.1				
60	100	360				
61	100	372.1				

Answer:

Q	TFC	TVC	ATC	AVC	MC	Profits
58	100	336.4	7.52	5.8	11.7	259.6
59	100	348.1	7.59	5.9	11.9	259.9
60	100	360	7.67	6.0	12.1	260
61	100	372.1	7.74	6.1	12.1	259.9

The optimal output for One Guy's Pizza is at 60 units. At this output level, One Guy's Pizza earns a profit of \$260.

Diff: 1

Section: 8.4

111) Spacely Sprockets' short-run cost curve is:

$$C(q, K) = \frac{25q^2}{K} + 15K,$$

where q is the number of Sprockets produced and K is the number of robot hours Spacely hires. Currently, Spacely hires 10 robot hours per period. The short-run marginal cost curve is:

$$MC(q, K) = 50\frac{q}{K}.$$

If Spacely receives \$250 for every sprocket he produces, what is his profit maximizing output level? Calculate Spacely's profits.

Answer: The profit maximizing output level is where the market price equals marginal cost (providing the price exceeds the average variable cost). To determine the optimal output level, we need to first

$$MC(q, K) = 50\frac{q}{10} = P = 250 \Leftrightarrow q = 50.$$

equate marginal cost to the market price. That is,

The average variable cost at this output level is:

$$AVC(50, 10) = \frac{25q}{K} = \frac{25(50)}{10} = 125.$$

Since $P > AVC(50, 10)$, Spacely will maximize profits at 50 units. Spacely's profits are:

$$\pi = Pq - C(q, 10) = 250(50) - \left\{ \frac{25(50)^2}{10} + 15(10) \right\} = 6,100.$$

Diff: 2

Section: 8.4

112) Laura's internet services has the following short-run cost curve:

$$C(q, K) = \frac{25q^3}{K^{2/3}} + rK$$

where q is Laura's output level, K is the number of servers she leases and r is the lease rate of servers. Laura's short-run marginal cost function is:

$$MC(q, K) = \frac{50q}{K^{2/3}}$$

Currently, Laura leases 8 servers, the lease rate of servers is \$15, and Laura can sell all the output she produces for \$500. Find Laura's short-run profit maximizing level of output. Calculate Laura's profits. If the lease rate of internet servers rise to \$20, how does Laura's optimal output and profits change?

Answer: The profit maximizing output level is where the market price equals marginal cost (providing the price exceeds the average variable cost). To determine the optimal output level, we need to first equate marginal cost to the market price. That is,

$$MC(q, 8) = 50 \frac{q}{(8)^{2/3}} = P = 500 \iff q = 40.$$

The average variable cost at this output level is:

$$AVC(40, 8) = \frac{25q}{K^{2/3}} = \frac{25(40)}{4} = 250.$$

Since $P > AVC(40, 8)$, Laura will maximize profits at 40 units. Laura's profits are:

$$\pi = Pq - C(q, 8) = 500(40) - \left\{ \frac{25(40)^2}{4} + 15(8) \right\} = 9,880.$$

If the lease rate of servers rise to \$20, Laura's short-run output level doesn't change as average variable cost and marginal cost are unaffected by the lease rate. Laura's profits will be affected. New profits are:

$$\pi_n = Pq - C(q, 8) = 500(40) - \left\{ \frac{25(40)^2}{4} + 20(8) \right\} = 9,840.$$

Thus, the \$5 increase in the rental rate reduced Laura's short-run profits by \$40.

Diff: 2

Section: 8.4

113) Homer's Boat Manufacturing cost function is:

$$C(q) = \frac{75}{128}q^4 + 10,240.$$

The marginal cost function is:

$$MC(q) = \frac{75}{32}q^3.$$

If Homer can sell all the boats he produces for \$1,200, what is his optimal output? Calculate Homer's profit or loss.

Answer: The profit maximizing output level is where the market price equals marginal cost (providing the price exceeds the average variable cost). To determine the optimal output level, we need to first equate marginal cost to the market price. That is,

$$MC(q) = \frac{75}{32}q^3 = P = 1,200 \Leftrightarrow q = 8.$$

The average variable cost at this output level is:

$$AVC(8) = \frac{75}{128}(8)^3 = \frac{75(512)}{128} = 300.$$

Since $P > AVC(8)$, Homer will maximize profits at 8 units. Homer's profits are:

$$\pi = Pq - C(q) = 1,200(8) - \left\{ \frac{75(8)^4}{128} + 10,240 \right\} = -3,040.$$

Homer will produce and make a loss as losing \$3,040 is better than not producing and losing \$10,240.

Diff: 2

Section: 8.4

114) A competitive firm sells its product at a price of \$0.10 per unit. Its total and marginal cost functions are:

$$TC = 5 - 0.5Q + 0.001Q^2$$

$$MC = -0.5 + 0.002Q,$$

where TC is total cost (\$) and Q is output rate (units per time period).

a. Determine the output rate that maximizes profit or minimizes losses in the shortterm.

b. If input prices increase and cause the cost functions to become

$$TC = 5 - 0.10Q + 0.002Q^2$$

$$MC = -0.10 + 0.004Q,$$

what will the new equilibrium output rate be? Explain what happened to the profit maximizing output rate when input prices were increased.

Answer:

a.

$$TR = PQ = 0.10Q \quad MR = 0.10$$

$$TC = 5 - 0.5Q + 0.001Q^2$$

$$MC = -0.5 + 0.002Q = 0.10 = MR$$

$$Q = 75$$

b.

$$MC = -0.10 + 0.004Q = 0.10 = MR$$

$$Q = 50$$

As a result of the increase in input costs, the firm's marginal cost increased. This caused the intersection of MC to occur at the lower production rate, 50 vs. 75. This also reduced the firm's level of profit.

Diff: 2

Section: 8.5

115) Sarah's Pretzel plant has the following short-run cost function:

$$C(q, K) = \frac{wq^3}{1000K^{3/2}} + 50K$$

where q is Sarah's output level, w is the cost of a labor hour, and K is the number of pretzel machines Sarah leases. Sarah's short-run marginal cost curve is

$$MC(q, K) = \frac{3wq^2}{1000K^{3/2}}$$

At the moment, Sarah leases 10 pretzel machines, the cost of a labor hour is \$6.85, and she can sell all the output she produces at \$35 per unit. If the cost per labor hour rises to \$7.50, what happens to Sarah's optimal level of output and profits?

Answer: First, we need to determine Sarah's optimal output and profits before the increase in the wage rate. The profit maximizing output level is where the market price equals marginal cost (providing the price exceeds the average variable cost). To determine the optimal output level, we need to first equate marginal cost to the market price. That is,

$$MC(q, K) = \frac{3wq^2}{1000K^{3/2}} = P = 35 \Leftrightarrow q = 232.07.$$

The average variable cost at this output level is:

$$AVC(232.07, 10) = \frac{wq^2}{1000K^{3/2}} = \frac{6.85(232.07)^2}{1000(10)^{3/2}} = 11.67.$$

Since $P > AVC(232.07, 10)$, Sarah will maximize profits at 232.07 units. Sarah's profits are:

$$\pi = Pq - C(q, 10) = 35(232.07) - \left\{ \frac{6.85(232.07)^3}{1000(10)^{3/2}} + 50(10) \right\} = 4,915.08.$$

To determine the optimal output level at the higher wage rate, we need to first equate marginal cost to the market price. That is,

$$MC(q, K) = \frac{3(7.50)q^2}{1000(10)^{3/2}} = P = 35 \Leftrightarrow q = 221.79.$$

The average variable cost at this output level is:

$$AVC(221.79, 10) = \frac{wq^2}{1000K^{3/2}} = \frac{7.50(221.79)^2}{1000(10)^{3/2}} = 11.66.$$

Since $P > AVC(221.79, 10)$, Sarah will maximize profits at 221.79 units. Sarah's profits are:

$$\pi = Pq - C(q, 10) = 35(221.79) - \left\{ \frac{7.50(221.79)^3}{1000(10)^{3/2}} + 50(10) \right\} = 4,675.11.$$

The higher wage rate causes Sarah to reduce output and her profits also fall. In this case, profits fall by 4.9% when the wage rate rises by 9.5%.

Diff: 3

Section: 8.5

116) The market demand for a type of carpet known as KP-7 has been estimated as:

$$P = 40 - 0.25Q,$$

where P is price (\$/yard) and Q is rate of sales (hundreds of yards per month). The market supply is expressed as:

$$P = 5.0 + 0.05Q.$$

A typical firm in this market has a total cost function given as:

$$C = 100 - 20.0q + 2.0q^2.$$

- Determine the equilibrium market output rate and price.
- Determine the output rate for a typical firm.
- Determine the rate of profit (or loss) earned by the typical firm.

Answer:

- a.** Equate supply to demand to get Q.

$$40 - 0.25Q = 5.0 + 0.05Q$$

$$0.30Q = 35$$

$$Q = 116.7 \text{ (hundreds of yards per month)}$$

$$P = 40 - 0.25(116.7) = \$10.825 / \text{yard}$$

- b.** The typical firm produces where MC equals P.

$$MC = -20 + 4q$$

$$10.825 = -20 + 4q$$

$$q = 7.71 \text{ (hundreds of yards per month)}$$

- c.** The profit rate is as follows:

$$R(Q) = PQ = (10.825)(7.71) = 83.461$$

$$TC = 100 - 20(7.71) + 2(7.71)^2 = 64.69$$

$$\text{Profit} = \$18.77 \text{ (hundreds / month)}$$

Diff: 1

Section: 8.6

117) A competitive market is made up of 100 identical firms. Each firm has a short-run marginal cost function as follows:

$$MC = 5 + 0.5Q,$$

where Q represents units of output per unit of time. The firm's average variable cost curve intersects the marginal cost at a vertical distance of 10 above the horizontal axis. Determine the market short-run supply curve. Calculate the price that would make 2,000 units forthcoming per time period. Note the minimum price at which any quantity would be placed on the market.

Answer: The market supply curve is the horizontal summation of the individual firms' MC curves above the intersection with the respective average variable cost curves. We must express the quantity in terms of MC or:

$$Q = 2MC - 10.$$

Now add the 100 short-run supply curves together:

$$Q_1 = 2MC - 10$$

$$Q_2 = 2MC - 10$$

$$\cdot \quad \cdot \quad \cdot$$

$$\cdot \quad \cdot \quad \cdot$$

$$\cdot \quad \cdot \quad \cdot$$

$$Q_{100} = 2MC - 10$$

$$\Sigma Q = 200MC - 1000$$

Now, solve for MC

$$MC = \frac{\Sigma Q + 1000}{200}$$

$$MC = 0.005\Sigma Q + 5 \text{ (above } MC = 10)$$

At $\Sigma Q = 2000$, the price would be

$$P = MC = 0.005(2000) + 5 = \$15 \text{ per unit.}$$

The lowest point on the supply curve would be just above the intersection with the average variable cost curve (at 10 units above the horizontal axis).

Diff: 1

Section: 8.6

118) The market for wheat consists of 500 identical firms, each with the total and marginal cost functions shown:

$$TC = 90,000 + 0.00001Q^2$$

$$MC = 0.00002Q,$$

where Q is measured in bushels per year. The market demand curve for wheat is $Q = 90,000,000 - 20,000,000P$, where Q is again measured in bushels and P is the price per bushel.

- Determine the short-run equilibrium price and quantity that would exist in the market.
- Calculate the profit maximizing quantity for the individual firm. Calculate the firm's short-run profit (loss) at that quantity.
- Assume that the short-run profit or loss is representative of the current long-run prospects in this market. You may further assume that there are no barriers to entry or exit in the market. Describe the expected long-run response to the conditions described in part b. (The TC function for the firm may be regarded as an economic cost function that captures all implicit and explicit costs.)

Answer:

a.

Market supply is horizontal sum of individual firm supply (firm's MC curve).

$$\text{Firm's } TC = 90,000 + 0.00001Q^2$$

$$MC = 0.00002Q = P.$$

Solve for Q in terms of P to express as supply curve

$$P = 0.00002Q$$

$$Q = 50,000P$$

Market supply curve is horizontal sum of firm supply curve or N -times the firm supply curve (N is the number of firms).

$$Q_S = 500(50,000)P$$

$$Q_S = 25,000,000P$$

equate Q_S and Q_D to determine price and quantity

$$25,000,000P = 90,000,000 - 20,000,000P$$

$$45,000,000P = 90,000,000$$

$$P = \$2.00$$

$$Q = 25,000,000P$$

$$Q = 25,000,000(2)$$

$$Q = 50,000,000$$

b.

To determine the firm's output, equate price and marginal cost - Firm's $MC = 0.00002Q$.

$$P = 2 = 0.00002Q$$

$$Q = 100,000$$

Firm's $\pi = TR - TC$

$$TR = 2.00(100,000)$$

$$TR = 200,000$$

$$TC = 90,000 + 0.00001Q^2$$

$$TC = 90,000 + 0.00001(100,000)^2$$

$$TC = 190,000$$

$$\pi = 200,000 - 190,000 = 10,000$$

c.

Firms are earning economic profit so we would expect entry to occur, causing the market supply curve to shift rightward. As the market supply curve shifts rightward, price falls, which in turn causes each firm to reduce its output. This will continue until we reach long-run equilibrium at zero profit.

Diff: 2

Section: 8.6

119) The market demand for a type of carpet known as KS-12 has been estimated as

$$P = 75 - 1.5Q,$$

where P is price (\$/yard), and Q is output per time period (thousands of yards per month). The market supply is expressed as $P = 25 + 0.50Q$. A typical competitive firm that markets this type of carpet has a marginal cost of production of

$$MC = 2.5 + 10q.$$

- Determine the market equilibrium price for this type of carpet. Also determine the production rate in the market.
- Determine how much the typical firm will produce per week at the equilibrium price.
- If all firms had the same cost structure, how many firms would compete at the equilibrium price computed in (a) above?
- Determine the producer surplus the typical firm has under the conditions described above. (Hint: Note that the marginal cost function is linear.)

Answer:

a.

Market equilibrium price is found by equating S and D.

$$75 - 1.5Q = 25 + 0.50Q$$

$$50 = 2Q$$

$$Q = 25 \text{ (thousand yards per month)}$$

The equilibrium selling price is

$$P = 75 - 1.5(25) = \$37.5/\text{yard}.$$

b.

Since the firm's supply is based on its MC curve, we can use MC to determine production rate.

$$P = 37.5 = MC = 2.5 + 10q$$

$$q = \frac{35}{10} = 3.5 \text{ (thousand yards / month)}$$

c.

Since each firm produces 3.5 thousand yards per month and total production is at 25 thousand yards per month, a total of 7.14 firms would be needed.

d.

Producer surplus is the area between the price of \$37.5 and MC, bounded by zero and 3.5 units of output for the typical firm. The bounded area is a triangle.

$$\text{Area} = \frac{1}{2} b \cdot h = (0.5)(3.5)(37.5 - 2.5) = \$61.25 \text{ (thousand)}$$

Diff: 1

Section: 8.6

120) Assume the market for tortillas is perfectly competitive. The market supply and demand curves for tortillas are given as follows:

supply curve:

$$P = .000002Q \quad \text{demand curve: } P = 11 - .00002Q$$

The short run marginal cost curve for a typical tortilla factory is:

$$MC = .1 + .0009Q$$

- Determine the equilibrium price for tortillas.
- Determine the profit maximizing short run equilibrium level of output for a tortilla factory.
- At the level of output determined above, is the factory making a profit, breaking-even, or making a loss? Explain your answer.
- Assuming that all of the tortilla factories are identical, how many tortilla factories are producing tortillas?

Answer:

a.

The equilibrium price is the price at which the quantity supplied equals the quantity demanded.

Therefore,

$$.000002Q = 11 - .00002Q$$

$$Q = 500,000$$

$$P = 1$$

b.

The profit maximizing short run equilibrium level of output for a tortilla factory is found where marginal revenue equals marginal cost. For a perfectly competitive firm, marginal revenue equals price.

Therefore,

$$P = MC$$

$$1 = .1 + .0009Q$$

$$Q = 1,000$$

c.

Given the information provided, it cannot be determined whether the firm is making a profit or a loss, because total cost cannot be determined from marginal cost.

d.

Since $Q = 500,000$ and $Q = 1,000$, there must be 500 firms.

Diff: 2

Section: 8.6

121) In the local cotton market, there are 1,000 producers that have identical short-run cost functions. They are: $C(q) = 0.025q^2 + 200$, where q is the number of bales produced each period. The short-run marginal cost function for each producer is: $MC(q) = 0.05q$. If the local cotton market is perfectly competitive, what is each cotton producer's short-run supply curve? Derive the local market supply curve of cotton.

Answer: Given the cotton market is competitive, the firms will set their marginal cost to the market price (i.e., they are price takers). The quantity supplied by each cotton producer can be found as follows:

$$MC(q) = 0.05q = P \Leftrightarrow q = 20P.$$

To determine the market supply, we add the quantity supplied for all producers together at each price. Thus,

$$Q_S = \sum_{i=1}^{1,000} 20P = 1000(20)P = 20,000P.$$

If we wanted to graph the supply with price on the vertical axis and quantity on the horizontal axis, we would solve the supply equation for price. This would be: $P = \frac{1}{20,000} Q_S$.

Diff: 2

Section: 8.6

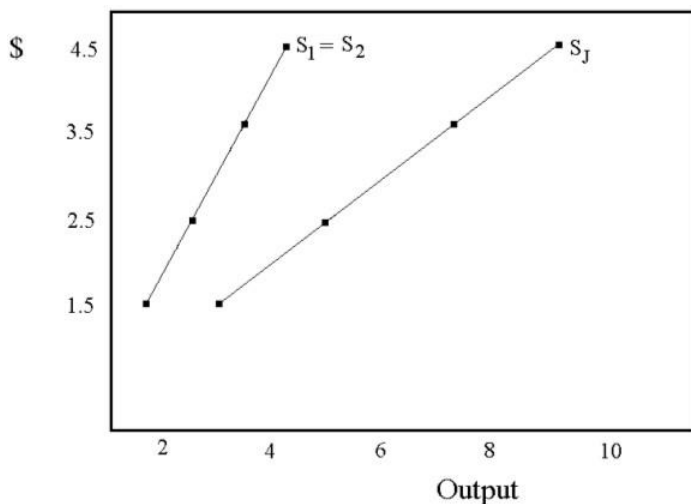
122) The table below provides cost information for two firms in a competitive industry. Graph the supply curves of the firms individually and jointly. For these two firms, at any positive output level, marginal cost exceeds average variable cost.

Q	Firm #1 Costs	Firm #2 Costs
1	25.5	30.5
2	27	32
3	29.5	34.5
4	33	38
5	37.5	42.5

Answer:

Q	Firm #1 Costs	MC	Firm #2 Costs	MC
1	25.5	1.5	30.5	1.5
2	27	2.5	32	2.5
3	29.5	3.5	34.5	3.5
4	33	4.5	38	4.5
5	37.5		42.5	

Since we know the industry is competitive and that the average variable cost is always exceeded by the marginal cost, the firm will be willing to supply the amount of output that sets the market price equal to the marginal cost in the short run. This implies we may graph Firm #1 (S_1) and Firm #2 (S_2) supply curves as indicated in the diagram below. To determine the joint supply (S_J) of these two firms, we add their individual supplies together for each price. The joint supply is indicated below.



Diff: 1

Section: 8.6

123) The marginal cost curves of six firms in an industry appear in the table below. If these firms behave competitively, determine the market supply curve. Calculate the elasticity of market supply at \$5.

Firm	Marginal cost
Firm #1	$3q_1 + 2$

Firm #2	$3q_2 + 1.5$
Firm #3	$3q_3 + 2.5$
Firm #4	$3q_4 + 2$
Firm #5	$3q_5 + 1.5$
Firm #6	$3q_6 + 2.5$

Answer: To determine each firm's individual supply, we need to solve for q when marginal cost is set equal to the market price.

$$MC(q_i) = 3q_i + b_i = P \Rightarrow q_i = \frac{P - b_i}{3}.$$

We can then add each firm's individual supply together at each price to determine the market supply. This is done in the following table:

Firm	Marginal cost
Firm #1	$\frac{P - 2}{3}$
Firm #2	$\frac{P - 1.5}{3}$
Firm #3	$\frac{P - 2.5}{3}$
Firm #4	$\frac{P - 2}{3}$
Firm #5	$\frac{P - 1.5}{3}$
Firm #6	$\frac{P - 2.5}{3}$
Market	$2P - 4$

The market supply is the sum of all the firms' quantity supplied at each price. As the table indicates, the market supply is: $Q_S = 2P - 4$. At a price of \$5, the quantity supplied is 6. So, the point elasticity of supply at \$5 is:

$$E_S = \left(\frac{\Delta Q_S}{\Delta P} \right) \frac{P}{Q_S} = (2) \frac{5}{6} = \frac{5}{3}.$$

Diff: 2

Section: 8.6

124) The long-run cost function for Jeremy's Jetski Rentals is: $C(q) = \frac{5}{2}q^2$. The long-run marginal cost function is $MC(q) = 5q$. If Jeremy can sell as many jetski rentals as he desires at \$50, calculate his optimal output in the long run.

Answer: Jeremy's optimal output occurs where price is equal to marginal cost if he can earn at least a normal profit at that output level. If not, his optimal output would be zero. First, we set

$$MC(q) = P \Leftrightarrow 5q = 50 \Leftrightarrow q = 10.$$

At this output level, Jeremy's average costs are: $AC(q) = \frac{5(10)}{2} = 25$.

Since price exceeds Jeremy's Average costs, Jeremy will maximize profits by producing 10 units of output.

Diff: 2

Section: 8.7

125) The long-run cost function for LeAnn's telecommunication firm is: $C(q) = 0.03q^2$. A local telecommunication tax of \$0.01 has been implemented for each unit LeAnn sells. This implies the marginal cost function becomes: $MC(q, t) = 0.06q + t$. If LeAnn can sell all the units she produces at the market price of \$0.70, calculate LeAnn's optimal output before and after the tax. What effect did the tax have on LeAnn's output level? How did LeAnn's profits change?

Answer: The profit maximizing output level is where the market price equals marginal cost (providing the price exceeds the average variable cost). To determine the optimal output level, we need to first equate marginal cost to the market price. That is,

$$MC(q, 0) = 0.06q + (0) = P = 0.7 \Leftrightarrow q = 11\frac{2}{3}.$$

The average variable cost at this output level is:

$$AVC\left(11\frac{2}{3}\right) = 0.03\left(11\frac{2}{3}\right) = 0.35. \text{ Since } P > AVC\left(11\frac{2}{3}\right),$$

LeAnn will maximize profits at $11\frac{2}{3}$ units. LeAnn's profits are:

$$\pi = Pq - C(q) = 0.70\left(11\frac{2}{3}\right) - \left\{0.03\left(11\frac{2}{3}\right)^2\right\} = 4\frac{1}{12}.$$

With the tax, LeAnn's optimal output level requires:

$$MC(q, 0.01) = 0.06q + (0.01) = P = 0.7 \Leftrightarrow q = 11.5.$$

The average variable cost at this output level is:

$$AVC(11.5) = 0.03(11.5) + .01 = 0.355.$$

Since $P > AVC(11.5)$, LeAnn will maximize profits at 11.5 units. LeAnn's profit with the tax is:

$$\pi = Pq - C(q) = 0.70(11.5) - \left\{0.03(11.5)^2 + 0.01(11.5)\right\} = 3.9675.$$

The tax reduces LeAnn's output and profit.

Diff: 2

Section: 8.7

126) The squishy industry is competitive and the market price is \$0.80. Apu's long-run cost function is:

$$C(q, r) = \frac{0.436}{3}r^{3/2}q^{3/2},$$

where r is the price Apu pays to lease a squishy machine and q is squishy output. The long-run marginal cost curve is:

$$MC(r, q) = 0.218r^{3/2}q^{1/2}.$$

What is Apu's optimal output if the price Apu pays to lease a squishy machine is \$1.10? Suppose the lease price of squishy machines falls by \$0.55. What happens to Apu's optimal output if the market price for a squishy remains at \$0.80? Did profits increase for Apu when the lease rate of squishy machines fell?

Answer: The profit maximizing output level is where the market price equals marginal cost (providing the price exceeds the average cost). To determine the optimal output level, we need to first equate marginal cost to the market price. That is,

$$MC(q, 1.10) = 0.218(1.10)^{3/2}q^{1/2} = P = 0.8 \Leftrightarrow q = 10.12.$$

The average variable cost at this output level is:

$$AC(10.12) = \frac{0.436}{3}(1.1)^{3/2}10.12^{1/2} = 1.69.$$

Since $P < AC(10.12)$, Apu will maximize profits by producing 0 units. Apu's profits will also be zero. If the lease rate of squishy machines fall by \$0.55, the optimal output will be determined by:

$$MC(q, 0.55) = 0.218(0.55)^{3/2}q^{1/2} = P = 0.8 \Leftrightarrow q = 17.65.$$

The average variable cost at this output level is:

$$AC(17.65) = \frac{0.436}{3}(0.55)^{3/2}17.65^{1/2} = 1.05.$$

Since $P < AC(17.65)$, Apu will maximize profits at 0 units. Apu's profits remain at zero even though squishy machines have fallen in price by 50%.

Diff: 2

Section: 8.7

127) Bud Owen operates Bud's Package Store in a small college town. Bud sells six packs of beer for off-premises consumption. Bud has very limited store space and has decided to limit his product line to one brand of beer, choosing to forego the snack food lines that normally accompany his business. Bud's is the only beer retailer physically located within the town limits. He faces considerable competition, however, from sellers located outside of town. Bud regards the market as highly competitive and considers the current \$2.50 per six pack selling price to be beyond his control. Bud's total and marginal cost functions are:

$$TC = 2000 + 0.0005Q^2$$

$$MC = 0.001Q,$$

where Q refers to six packs per week. Included in the fixed cost figure is a \$750 per week salary for Bud, which he considers to be his opportunity cost.

- Calculate the profit maximizing output for Bud. What is his profit? Is this an economic profit or an accounting profit?
- The town council has voted to impose a tax of \$.50 per six pack sold in the town, hoping to discourage beer consumption. What impact will the tax have on Bud? Should Bud continue to operate? What impact will the tax have on Bud's out-of-town competitors?

Answer: *a.*

Given the competitive nature of the market, Bud should equate P to MC.

$$2.50 = 0.001Q$$

$$Q = 2500$$

$$TR = 2.5 \times 2500 = 6250$$

$$TC = 2000 + 0.0005(2500)^2$$

$$TC = 2000 + 3125$$

$$TC = 5125$$

$$\pi = 6250 - 5125$$

$$\pi = 1,125$$

Since the cost function is an economic cost function, we can conclude that this is an economic profit.

b.

Tax shifts total cost curve to:

$$TC = 2000 + 0.0005Q^2 + 0.5Q$$

MC becomes

$$MC = 0.001Q + 0.5$$

setting P = MC

$$\$2.50 = 0.001Q + 0.5$$

$$2.00 = 0.001Q$$

$$Q = 2000$$

$$TR = 2.50 \times 2000$$

$$TR = 5000$$

$$TC = 2000 + 0.0005(2000)^2 + 0.5(2000)$$

$$TC = 2000 + 2000 + 1000$$

$$TC = 5000$$

$$\pi = 5000 - 5000$$

$$\pi = 0$$

Given that this is zero economic profit, Bud should continue operating.

The impact upon Bud's competitors will be favorable or neutral. As he curtails output, 500 six packs worth of business will either shift elsewhere or choose temperance.

Diff: 2

Section: 8.8

128) Consider a competitive market in which the market demand for the product is expressed as

$$P = 75 - 1.5Q,$$

and the supply of the product is expressed as

$$P = 25 + 0.50Q.$$

Price, P , is in dollars per unit sold, and Q represents rate of production and sales in hundreds of units per day. The typical firm in this market has a marginal cost of

$$MC = 2.5 + 10q.$$

- Determine the equilibrium market price and rate of sales.
- Determine the rate of sales of the typical firm, given your answer to part (a) above.
- If the market demand were to increase to $P = 100 - 1.5Q$, what would the new price and rate of sales in the market be? What would the new rate of sales for the typical firm be?
- If the original supply and demand represented a long-run equilibrium condition in the market, would the new equilibrium (c) represent a new long-run equilibrium for the typical firm? Explain.

Answer:

a.

The equilibrium price and rate of sales are computed by equating supply to demand.

$$25 + 0.5Q = 75 - 1.5Q$$

$$2Q = 50$$

$$Q = 25 \text{ (hundreds per day)}$$

The equilibrium price is

$$P = 75 - 1.5Q$$

$$= 75 - 1.5(25)$$

$$= \$37.5$$

b.

Since the firm's supply curve is its MC, we can determine the rate of sales of the firm by inserting \$37.5 for price (MC) into the MC equation to get q for the firm.

$$MC = \$37.5 = 2.5 + 10q.$$

$$q = 3.5 \text{ (hundreds per day)}$$

c.

The new market equilibrium price is

$$25 + 0.50Q = 100 - 1.5Q$$

$$Q = 75 / 2 \text{ (hundreds per day)}$$

$$P = 100 - 1.5(37.5) = \$43.75 / \text{unit}$$

Now the typical firm would sell daily:

$$MC = 43.75 = 2.5 + 10q$$

$$q = 4.126 \text{ (hundred per day)}$$

d.

The original supply and demand represented long-run equilibrium and a breakeven situation for the typical firm. With the new higher demand in (c), the typical firm would likely be earning a positive economic profit because price and output are both higher. This apparent positive profit would encourage more firms to enter the market, which would increase market supply. So, the new equilibrium would not represent a long-run equilibrium for the firm or the market.

Diff: 2

Section: 8.8

129) In the long-run equilibrium of a competitive market, the market supply and demand are:

$$\text{Supply: } P = 30 + 0.50Q$$

$$\text{Demand: } P = 100 - 1.5Q,$$

where P is dollars per unit and Q is rate of production and sales in hundreds of units per day. A typical firm in this market has a marginal cost of production expressed as:

$$MC = 3.0 + 15q.$$

- Determine the market equilibrium rate of sales and price.
- Determine the rate of sales by the typical firm.
- Determine the economic rent that the typical firm enjoys. (Hint: Note that the marginal cost function is linear.)
- If an output tax is imposed on ONE firm's output such that the ONE firm has a new marginal cost (including the tax) of: $MC_t = 5 + 15q$, what will the firm's new rate of production be after the tax is imposed? How does this new production rate compare with the pre-tax rate? Is it as expected? Explain. Would the effect have been the same if the tax had been imposed on all firms equally? Explain.

Answer:

a.

The market equilibrium price and sales rate are determined as follows:

Supply = Demand

$$30 + 0.50Q = 100 - 1.5Q$$

$$Q = 70/2 = 35 \text{ (hundred per day)}$$

$$P = 30 + 0.50(35) = \$47.5 / \text{unit}$$

b.

The rate of sales by the typical firm is determined from the firm's MC curve.

$$MC = 47.5 = 3 + 15q$$

$$q = 2.967 \quad \text{(hundred per day)}$$

c.

The economic rent that the firm earns in the long-run is equal to the producer surplus that it generates. The producer surplus is the area of the triangle bounded by price, MC, and production rate, a triangle.

$$P = 47.5 \quad q = 2.833 \quad MC \text{ (lower point)} = 3$$

$$\begin{aligned} \text{Economic rent} &= (1/2)b \cdot h = (0.5)(2.967)(47.5 - 3) \\ &= \$66.016 \text{ (hundreds)} \end{aligned}$$

d.

The market price is expected to stay the same since the tax is imposed on the one firm. Thus, the production rate for the firm is determined at the intersection of price and MC_t of the firm.

$$47.5 = 5 + 15q$$

$$q = 2.833 \quad \text{(hundreds of units per day)}$$

This production rate is slightly less than the pre-tax rate, as expected. The tax had the effect of shifting the MC curve vertically upward. This resulted in an intersection with the price line at 2.833 instead of 2.967.

The effect would not have been the same if the tax had been imposed equally on all firms. With the tax on all firms, the equilibrium market price would have increased. The industry supply curve would have shifted upward and total industry output would have decreased. Instead of the one firm being affected with one firm being taxed, the industry equilibrium price and output would be affected when the tax was imposed on all firms.

Diff: 2

Section: 8.8

130) The demand curve and long-run supply curve for carpet cleaning in the local market are: $Q_D = 1,000 - 10P$ and $Q_S = 640 + 2P$. The long-run cost function for a carpet cleaning business is: $C(q) = 3q^2$. The long-run marginal cost function is: $MC(q) = 6q$. If the carpet cleaning business is competitive, calculate the optimal output for each firm. How many firms are in the local market? Is the carpet cleaning industry an increasing, constant, or decreasing cost industry?

Answer: To determine optimal firm output, we first must calculate the market price. To do so we set market demand equal to market supply and solve for price. That is:

$$Q_D = 1,000 - 10P = Q_S = 640 + 2P \Rightarrow P = 30.$$

At this market price, 700 carpets will be cleaned. Since the industry is competitive, we know the firms are price takers and will set their marginal costs equal to the market price. This gives us:

$$MC(q) = 6q = 30 \Rightarrow q = 5.$$

Given each firm is cleaning 5 carpets per period and there are a total of 700 carpets cleaned each period

$$AC(q) = \frac{3q^2}{q} = 3q,$$

in the market, there must be 140 firms. Since each firm's average costs are increases in output raises the firm's average cost. Thus, each firm has increasing costs. Also, since the market supply curve is upward sloping in the long-run, as output expands in the long-run the industry is an increasing price industry.

Diff: 2

Section: 8.8

131) The demand for pizzas in the local market is given by: $Q_D = 25,000 - 1,500P$. There are 100 pizza firms currently in the market. The long-run cost function for each pizza firm is:

$$C(q, w) = \frac{10}{7}wq,$$

where w is the wage rate pizza firms pay for a labor hour and q is the number of pizzas produced. The marginal cost function for each firm is:

$$MC(q, w) = \frac{10}{7}w.$$

If the current wage rate is \$7 and the industry is competitive, calculate the optimal output of each firm given each firm produces the same level of output. Do you anticipate firms entering or exiting the pizza industry? Suppose that the wage rate increases to \$8.40. Calculate optimal output for each of the 100 firms. Do you anticipate firms entering or exiting the pizza industry? What happens to the market output of pizzas with the higher wage rate? What happens to the market price for pizza?

Answer: To determine the optimal output of each firm in a competitive industry, we know each firm will set their marginal cost to the market price. In this case, the marginal cost is constant at \$10. Thus, the market price must be \$10. At this price, 10,000 pizzas are demanded. Since there are 100 firms in the industry and they divide the industry output equally, each firm is producing 100 pizzas each period. The average cost per pizza in the long-run is equivalent to the price firms receive, thus, the firms are earning only the normal profit. This implies there is no incentive for firms to enter or exit the industry. If the wage rate rises to \$8.40, the marginal cost of producing a pizza rises to \$12. This implies that in the long-run, the market price of pizza will be \$12. At this price, consumers' quantity demanded of pizzas is 7,000. The optimal output for the 100 firms is 70 pizzas per firm. Since this is also a long-run equilibrium, there is no incentive for firms to enter or exit the industry. At the higher wage rate, the market output of pizzas decline. Also, the market price for pizzas increased by 20% when the wage rate increased by 20%.

Diff: 2

Section: 8.8

132) In the robotics industry there are 100 firms. Each firm shares the same long-run cost function. It is: $C(q) = 100\sqrt{q}$. The relevant marginal cost function is $MC(q) = \frac{50}{\sqrt{q}}$.

Each of the 100 firms produce 64 units. The market demand for robotics is: $Q_D = 15,000 - 688P$. Calculate the market price at this production level. Also, calculate the profits for a representative firm in the robotics industry. If one firm expanded production to 100 units while the remaining 99 firms kept output at 64 units, what would happen to the market price and profits? Would all firms benefit or lose if every firm expanded output to 100 units?

Answer:

If each firm is producing 64 units, the aggregate market output is 6,400. This implies that consumers are paying \$12.50 for each unit. Each firm is making a profit equal to:

$\pi = 64(12.50) - 100(8) = 800 - 800 = 0$. If one firm expanded its output to 100 units while the remaining 99 firms kept their output at 64 units, there would be a total of 6,436 units brought to market. Using the market demand, we see that consumer's would pay \$12.448 per unit. The firm that expanded their production will earn: $\pi = 100(12.448) - 100(10) = 244.8$. The other 99 firms will earn: $\pi = 64(12.448) - 100(8) = -3.328$. The one firm who expands its operations are able to increase profits while the remaining 99 firms earn an economic loss. If every firm expanded production to 100 units, there would be 10,000 units produced. At this output level, consumers will pay \$7.267 per unit. This implies each firm will earn: $\pi = 7.267(100) - 100(10) = -273.3$. This implies that all of the firms are worse-off if everyone in the industry expands output to 100 units.

Diff: 2

Section: 8.8

133) The manufacturing of paper products causes damage to a local river when the manufacturing plant produces more than 1,000 units in a period. To discourage the plant from producing more than 1,000 units, the local community is considering placing a tax on the plant. The long-run cost curve for the paper producing firm is:

$$C(q, t) = \frac{q^2}{1500} + tq,$$

where q is the number of units of paper produced and t is the per unit tax on paper production. The relevant marginal cost curve is:

$$MC(q, t) = \frac{q}{750} + t.$$

If the manufacturing plant can sell all of its output for \$2, what is the firm's optimal output if the tax is set at zero? What is the minimum tax rate necessary to ensure that the firm produces no more than 1,000 units? How much are the firm's profits reduced by the presence of a tax?

Answer: In the absence of a tax, we know the plant will maximize profits where marginal cost is equal to the price (given average costs exceed the market price). That is,

$$MC(q, 0) = \frac{q}{750} + (0) = 2 \Rightarrow q = 1,500.$$

Thus, without a tax, we know the plant will produce at a level that will cause damage to the river. The firm's profits at this level are:

$$\pi = 2(1,500) - \left\{ \frac{(1,500)^2}{1,500} + 0(1,500) \right\} = 1,500.$$

To ensure that the plant doesn't go beyond 1,000 units of production, the community needs to make sure the firm's marginal cost is equivalent to the market price at 1,000 units or less. That is,

$$MC(1000, t) = \frac{1000}{750} + t = 2 \Rightarrow t = 2 - 1\frac{1}{3} = \frac{2}{3}.$$

A tax of $\frac{2}{3}$ or greater will ensure the plant will not produce beyond 1,000 units. If we set the tax rate at $\frac{2}{3}$, the firm's profits will be:

$$\pi = 2(1,000) - \left\{ \frac{(1,000)^2}{1,500} + \frac{2}{3}(1,000) \right\} = 666\frac{2}{3}.$$

Implementation of a tax equal to $\frac{2}{3}$ will result in profits declining by 55.6%.

Diff: 3

Section: 8.8