

## How to Study for Classes 11 and 12 Perfect Competition

Classes 11 and 12 introduces the decision making process for companies in perfect competition. It is a technical chapter and needs to be studied slowly.

1. Begin by looking over the Objectives listed below. This will tell you the main points you should be looking for as you read the chapter.
2. New words or definitions and certain key points are highlighted in italics and in red color. Other key points are highlighted in bold type and in blue color.
3. You will be given an In Class Assignment and a Homework assignment to illustrate the main concepts of this chapter.
4. There are several new words in this chapter. Be sure to spend time on the various definitions. There are also many calculations. Go over each carefully. Be sure you understand how each number was derived (do the calculations for yourself). The calculations of this chapter continue the same case from the calculations of the previous two chapters.
5. When you have finished the text, the Test Your Understanding questions, and the assignments, go back to the Objectives. See if you can answer the questions without looking back at the text. If not, go back and re-read that part of the text. Then, take the Practice Quiz for Classes 11 and 12.

## Objectives for Classes 11 and 12 Perfect Competition

At the end of classes 11 and 12, you will be able to answer the following:

1. In perfect competition, what is **the demand curve facing the seller**? Why?
2. Define "**marginal revenue**".
3. Using the procedures for rational decision-making, explain why a company that is a price taker will produce up to the quantity at which **the marginal revenue equals the marginal cost**.
4. What should a company do if the marginal revenue is greater than the marginal cost? Why? What should a company do if the marginal revenue is less than the marginal cost? Why?
5. Explain the **shutdown rule**. That is, if a company is making economic losses, in the short-run, when should it continue to produce and when should it temporarily shut-down? Give some examples.
6. Explain why grocery stores and restaurants are open late at night, when there are few customers.
7. What is **the short-run supply of one seller**? (Remember: this is the curve which tells how much the seller will produce at any given price.)
8. From the supply of one seller, how does one derive **the market supply curve**? Why does it rise?
9. Explain how purely competitive companies adjust in the long-run when they are making economic profits and economic losses and show this on the graph.
10. Explain what is meant by "**long-run equilibrium**"?

## Classes 11 and 12: Perfect Competition (latest revision August 2004)

We begin our analysis of business behaviors by assuming perfect competition. *In perfect competition, each seller is so small in relation to the entire market that he or she cannot affect*

*the price.* No industry has completely perfect competition. But by studying it, we can gain many important insights into actual business behavior.

## 1. The Decision as to the Quantity to Produce

Let us consider a construction company. Assume that the price of homes is \$200,000 per home. Our construction company can sell as many or as few homes as is desired at that price. The company would never sell for less because it can always get \$200,000 per home. And if it asked for a higher price, it would sell nothing. *The demand as seen by one seller is perfectly elastic* at the market price of \$200,000.

Remember the procedures for **rational decision-making**. In analyzing the decision-making of the construction company, we must consider the choices one-at-a-time. Should we produce and sell the first home? To answer this, we must know the answer to two questions. First, what is the marginal benefit? The benefit in this case is the addition to total revenue. Second, what is the addition to total cost? The addition to total cost is, of course, the marginal opportunity cost, which was calculated in Class 7. *The addition to total revenue from producing and selling one more home is called the marginal revenue.* We can calculate it as follows:

$$\text{Marginal Revenue} = \frac{\text{Change in Total Revenue}}{\text{Change in Quantity Produced}}$$

Quantity	Total Revenue	Marginal Revenue	Total Cost	Marginal Cost
0	0		\$180,000	
1	\$200,000	\$200,000	340,000	\$160,000
2	400,000	200,000	480,000	140,000
3	600,000	200,000	600,000	120,000
4	800,000	200,000	740,000	140,000
5	1,000,000	200,000	900,000	160,000
6	1,200,000	200,000	1,080,000	180,000
7	1,400,000	200,000	1,280,000	200,000
8	1,600,000	200,000	1,500,000	220,000
9	1,800,000	200,000	1,740,000	240,000
10	2,000,000	200,000	2,000,000	260,000
11	2,200,000	200,000	2,280,000	280,000
12	2,400,000	200,000	2,580,000	300,000
13	2,600,000	200,000	2,900,000	320,000

*The total revenue is simply the price times the quantity. The marginal revenue is the change in the total revenue from producing and selling each additional home (that is, the change from \$200,000 to \$400,000, the change from \$400,000 to \$600,000, and so forth). Notice that the marginal revenue is always equal to the price.* Every time we sell another home, we sell it for \$200,000. This adds \$200,000 to our total revenue. (Ignore how the cost numbers were developed. That is not considered in this course. **But notice that marginal cost increases as more homes are produced.** That results from the law of diminishing returns.)

Should we produce and sell the first home? This home adds \$200,000 to our total revenue and \$160,000 to our total cost. Since it adds \$40,000 to our profits, it would seem desirable to produce this home. Should we produce the second home? It adds \$200,000 more to our total revenue and \$140,000 to our total cost. Therefore, it increases our total profits by \$60,000. We should produce it. Should we produce the third home? It adds \$200,000 more to our total revenue and \$120,000 to our total cost. Therefore, it adds \$80,000 to our total profits. We should produce it. By the same reasoning, we should produce homes #4, #5, and #6. Each home adds more to our total revenue than to our total cost. Should we produce home #7? This home adds \$200,000 to our total revenue and \$200,000 to our total cost. It adds nothing to our total profit but also subtracts nothing from it. We will include it by convention.

Should we produce home #8? This home adds another \$200,000 to our total revenues but adds \$220,000 to our total cost. Therefore, it reduces our total profit by \$20,000. We should NOT produce this home. At this point, we can stop the analysis. We conclude that we will maximize our total profits if we produce 7 homes.

We can summarize the argument. *If the marginal revenue is greater than the marginal cost, we can increase total profits by producing more. If the marginal revenue is less than the marginal cost, we can increase our total profits by producing less. We maximize our total profits by producing that quantity at which the marginal revenue equals the marginal cost.*

Since we have maximized this profit, how much total profit did we earn? From the number set, this calculation is easy. The total revenue is \$1,400,000. The total cost is \$1,280,000 (Ignore how this was determined.) Therefore, the economic profit is \$120,000 (\$1,400,000 - \$1,280,000). *Remember that this means that the owners earned a return on this business equal to the return that could have been earned in the next best alternative plus an additional \$120,000.*

### Test Your Understanding

Go back to the case of the orange grove in Class 7. Assume that the company sells its product in perfect competition at a market price of \$0.60 per pound. Using the principles described in the reading, the profit-maximizing quantity is \_\_\_\_\_ and the economic profit is \$\_\_\_\_\_. SHOW ALL CALCULATIONS

Quantity	Total Revenue	Marginal Revenue	Marginal Cost
10,000			
40,000			
90,000			
130,000			
160,000			
180,000			
192,000			
198,000			
200,000			

## 2. The Shutdown Decision

In perfect competition, the price is set in the market. No one company can have any influence over the price. Let us assume that the demand for homes falls and the market price now falls to

\$160,000 per home. In this case, the marginal revenue will also be \$160,000, for the reasons given above. Since we produce up to that quantity at which the marginal revenue and the marginal cost are equal, how many homes will the company now choose to produce? Check the numbers below:

Quantity	Total Revenue	Marginal Revenue	Total Cost	Marginal Cost
0	0		\$180,000	
1	\$160,000	\$160,000	\$340,000	\$160,000
2	320,000	160,000	480,000	140,000
3	480,000	160,000	600,000	120,000
4	640,000	160,000	740,000	140,000
5	800,000	160,000	900,000	160,000
6	960,000	160,000	1,080,000	180,000
7	1,120,000	160,000	1,280,000	200,000
8	1,280,000	160,000	1,500,000	220,000
9	1,440,000	160,000	1,740,000	240,000
10	1,600,000	160,000	2,000,000	260,000
11	1,760,000	160,000	2,280,000	280,000
12	1,920,000	160,000	2,580,000	300,000
13	2,080,000	160,000	2,900,000	320,000

If the marginal revenue is \$160,000, the company will now produce only 5 homes (where the marginal revenue of \$160,000 equals the marginal cost). Beyond that, each home will add less to total revenue than to total cost and its profits will fall. What is the new economic profit? The total revenue is \$800,000 ( $\$160,000 \times 5$ ). The total cost is \$900,000. Thus, there is an **economic loss** of \$100,000. The company's owners will earn \$100,000 less than they would have earned in their next best alternative. There is no quantity it could produce and earn an economic profit.

Since the company is earning an economic loss, should it continue to produce at all? The answer is "yes". Remember that we are still in the short-run. If you choose to shut-down, what is its economic profit? The answer is  $-\$180,000$ . **The reason is that the fixed cost (\$180,000) must be paid even if it produces nothing.** The fixed cost is shown in the table as the cost that results when the company produces zero homes. The company is better off losing \$100,000 than losing \$180,000. **In any decision, the only factors relevant are those that are changed by the decision.** If it produces 5 homes, the total revenue is \$800,000. If it produces zero, the total revenue is zero. Therefore, total revenue is relevant to the decision. If it produces 5 homes, the total variable cost is \$720,000 (the total cost of \$900,000 minus the fixed cost of \$180,000). If it produces zero, the total variable cost is zero. Therefore, total variable cost is relevant to the decision. But if it produces 5 homes, the total fixed cost is \$180,000. If it produces zero, the total fixed cost is still \$180,000. Therefore **total fixed cost is NOT relevant** to your decision. (Remember that you lose the implicit costs and also must pay the interest to the bank, even if you do not produce.)

***We can summarize. To maximize economic profits, produce the quantity for which the marginal revenue equals the marginal cost. If there is an economic profit, there is nothing more for you to do. But if there is an economic loss, in the short-run, produce that quantity if***

*the total revenue is greater than or equal to the total variable cost. Shut down if the total revenue is less than the total variable cost.*

Suppose that the market price now falls to \$120,000. The table shows the new calculations.

Quantity	Total Revenue	Marginal Revenue	Total Cost	Marginal Cost
0	0		\$180,000	
1	\$120,000	\$120,000	340,000	\$160,000
2	240,000	120,000	480,000	140,000
3	360,000	120,000	600,000	120,000
4	480,000	120,000	740,000	140,000
5	600,000	120,000	900,000	160,000
6	720,000	120,000	1,080,000	180,000
7	840,000	120,000	1,280,000	200,000
8	960,000	120,000	1,500,000	220,000
9	1,080,000	120,000	1,740,000	240,000
10	1,200,000	120,000	2,000,000	260,000
11	1,320,000	120,000	2,280,000	280,000
12	1,440,000	120,000	2,580,000	300,000
13	1,560,000	120,000	2,900,000	320,000

If we look for the point where marginal revenue equals the marginal cost, it would appear that the company should produce 3 homes. But this is not so. If it did, the economic profit would be  $\$360,000 - \$600,000 = -\$240,000$ . But the company never has to lose \$240,000. If it just shuts-down, it can reduce the economic loss to \$180,000. It has avoided all variable costs; it loses just the fixed cost that must be paid. The total revenue (\$360,000) is less than the total variable cost (\$420,000). Therefore, if the price of homes is \$120,000, the company should shut-down in the short-run and not produce any homes.

There are many examples of the shutdown rule. (1) If you walk into a grocery store at 3.00 in the morning, you will see only a few customers. Surely, the store could never be earning a profit with this small number of customers. So why are they open? The answer is that they believe they will earn enough revenue to cover their variable costs. The variable costs are very low. The cost of the building is fixed. Since the workers are there anyway to stock the shelves, the labor is fixed as well. The lights and heat or air conditioning would be on for the workers to stock shelves. There are very few variable costs of being open at 3.00 in the morning: some extra computer time, bags, and so forth. As long as the revenue is expected to cover these low costs, it pays to be open. The same principle explains why restaurants are open all night, when there are few customers. (2) Airlines often fly with planes that seem basically empty. Why would an airline company make a flight with 50 passengers in a plane with 150 seats? The answer, again, is that they believe the revenue will cover the variable costs. The main cost is the cost of the airplane and this is fixed. If the airplane flies at all, the fuel becomes fixed as does the movie. The crew has to be paid for so many hours of flying per month, so their cost is fixed. There are few variable costs (meals, extra fuel, ticket processing, and so forth). As long as the revenue is expected to cover these low variable costs, it pays to make the flight, even with only 50 passengers. Of course, if all flights had this small number, the company would be in financial

trouble. (3) In international trade, countries that are members of the World Trade Organization (such as the United States) are expected to have low tariffs (taxes) on the products of other countries. In order to qualify for these low tariffs, countries are expected to follow certain rules. One of these rules is that there should be no ***dumping***. ***One definition of dumping is selling products in another country at a price below the cost of production.*** If a country does this, the other country is allowed to impose tariffs. There have been many complaints by American companies of dumping by foreign companies. Most of these complaints have been found to be not valid. But one that was valid was the complaint against Japanese producers of steel. As a result, the United States imposed tariffs against steel products from Japan. Why would Japanese steel companies sell steel in the United States at a price below the cost of production? The answer, again, is that the revenues were covering the variable costs. But what was unique about this example is that, **at the same market price of steel, the Japanese companies were selling steel in the United States (at a loss) while the American steel companies were shutting down. What this tells us is that the variable costs must be higher for American steel companies than for Japanese steel companies.** The difference results from the way the two countries consider labor. In the United States, labor is a variable cost. When sales fall, workers are laid-off. In Japan, labor is a fixed cost. In steel companies, workers are hired for life (actually to age 60). If sales fall, the workers will be paid anyway, even if there is no work for them. Therefore, in Japan, the only variable costs are the costs of the natural resources (coal and iron). As long as the total revenue covers these costs, it pays for the steel companies to continue production. In the United States, the total revenues must cover the costs of the natural resources and the labor; otherwise, the steel companies will shut-down.

### Test Your Understanding

1. Go back to the case of the orange grove. Assume that the company sells its product in perfect competition at a market price of \$0.40 per pound. Using the principles described in the reading, the profit-maximizing quantity is \_\_\_\_\_ and the economic profit is \$\_\_\_\_\_. SHOW ALL CALCULATIONS

Quantity	Total Revenue	Marginal Revenue	Marginal Cost
10,000			
40,000			
90,000			
130,000			
160,000			
180,000			
192,000			
198,000			
200,000			

Since the company is making an economic loss, should it continue to produce in the short-run or should it shut down? Why?

2. Consider again the case of the same orange grove. Assume that the company sells its product in perfect competition at a market price of \$0.30 per pound. Using the principles described in the reading, the profit-maximizing quantity is \_\_\_\_\_ and the economic profit is \$\_\_\_\_\_. SHOW ALL CALCULATIONS

Quantity	Total Revenue	Marginal Revenue	Marginal Cost
10,000			
40,000			
90,000			
130,000			
160,000			
180,000			
192,000			
198,000			
200,000			

Since the company is making an economic loss, should it continue to produce in the short-run or should it shut down? Why?

### 3. The Short Run Supply

Examine the marginal cost data above. If the price is \$200,000 per home, the construction company will produce 7 homes. If the price is \$180,000 per home, the company will produce 6 homes. At the price of \$160,000 per home, the company will produce 5 homes and at the price of \$140,000, the company will produce 4 homes. At the price of \$120,000 or lower, the company will produce zero homes. Now let us examine the effects of prices higher than \$200,000. At a price of \$220,000, the company will produce 8 homes. (The marginal revenue of \$220,000 will equal the marginal cost at this quantity. Check this with the numbers above.) At a price of \$240,000, the company will produce 9 homes. At a price of \$260,000, the company will produce 10 homes. And so forth. ***Each point on the marginal cost tells us how many homes will be produced at that given price.*** "The quantity produced at each possible price" is the definition of "**supply**". Therefore, ***the supply for one seller is given by its marginal cost. But when the total revenue falls below the variable cost, the company will produce zero houses.***

***To obtain the short-run supply for the entire industry, all we need to do is add up the quantity each company will produce.*** For simplicity, let us assume that there are 1000 companies and that they are all identical. Examine the industry supply curve below. It is the same supply curve as was given when we first introduced the concept of supply.

Price	Supply of One Company	Industry Supply	Demand
\$140,000	4	4,000	10,000
\$160,000	5	5,000	9,000
\$180,000	6	6,000	8,000
\$200,000	7	7,000	7,000
\$220,000	8	8,000	6,000
\$240,000	9	9,000	5,000
\$260,000	10	10,000	4,000
\$280,000	11	11,000	3,000
\$300,000	12	12,000	2,000
\$320,000	13	13,000	1,000

*Notice that the industry supply increases as the price rises. This results from the fact that marginal cost increases as more homes are produced. Marginal cost increases as a result of the law of diminishing marginal returns. Each additional home will cost more to produce; therefore the price must rise to make it desirable for it to be produced. This is the Law of Supply.*

In the data above, the short-run industry supply is shown along with the demand for homes. This market demand was given when we first introduced the concept of demand. The intersection shows that **the equilibrium price is \$200,000 per home and the equilibrium quantity is 7,000 homes.** Review Class 5 on equilibrium. You will see that, at that point, the equilibrium price was \$200,000 and the equilibrium quantity was 7,000. Now, we know why.

### Test Your Understanding

Go back to the case of the orange grove once again. Fill-in the following table. Assume that there are 1000 orange groves and that they are identical. (Remember, in your answer, at some point the company may shut down.)

Price	Supply of One Grove	Industry Supply	Quantity Demanded
\$0.30			200,000,000
\$0.40			190,000,000
\$0.60			180,000,000
\$1.00			170,000,000
\$2.00			120,000,000
\$6.00			80,000,000

The equilibrium price is \$\_\_\_\_\_ and the equilibrium quantity of oranges is \_\_\_\_\_.

## 4. Perfect Competition in the Long-Run

Thus far, we have been considering the short-run, in which the number of companies stays the same (at 1,000). To complete our analysis of perfect competition, it is now time to turn to the long-run and allow the number of companies to change. Above, it was shown that the equilibrium price of homes was \$200,000 and the equilibrium quantity was 7,000. Our representative construction company produced 7 homes and earned an economic profit of \$120,000. ***This means that the owner earned \$120,000 more income than could be earned in the next best alternative.*** In the long-run, this should attract new sellers. These new sellers will realize that they can earn more in the construction industry than they are presently earning doing whatever it is that they are doing. In perfect competition, there are no barriers to their entry. Assume new sellers enter and the supply increases from Old Supply to New Supply as follows:

Price	Old Supply( $S_1$ )	Demand	New Supply( $S_2$ )
\$120,000	3,000	11,000	5,000
140,000	4,000	10,000	6,000
160,000	5,000	9,000	7,000
180,000	6,000	8,000	8,000
200,000	7,000	7,000	9,000
220,000	8,000	6,000	10,000
240,000	9,000	5,000	11,000
260,000	10,000	4,000	12,000
280,000	11,000	3,000	13,000
300,000	12,000	2,000	14,000
320,000	13,000	1,000	15,000

**The new supply ( $S_2$ ) is greater than (to the right of) the old supply ( $S_1$ ) as a result of the increase in the number of sellers. As a result, the equilibrium price will fall.** The new equilibrium price becomes \$180,000. (Check this for yourself.) From looking at the number set, you can see that, at the price of \$180,000, the representative company now produces 6 homes (where the price = marginal revenue = marginal cost). The economic profit is now \$1,080,000 (\$180,000 times 6 homes) minus the total cost of \$1,080,000, equals zero.

Why does the price fall to \$180,000? *The answer is that new sellers will continue to enter, increasing the supply, and lowering the price until the economic profit equal to zero. At an economic profit of zero, there is no more reason for a new seller to enter.* If the economic profit is zero, entering the construction industry will neither increase or decrease one's income. The number of sellers will stay the same. *When economic profits equal zero and the number of sellers will not change, the situation is called long-run equilibrium.*

### Test Your Understanding

1. Try using the same numbers but assuming that the market price had started at \$160,000 per home. We already showed what would happen in the short-run. Now explain what will result in the long-run.
2. Go back to the case of the orange grove. Assume that the market price of oranges is \$0.40 per pound. You have already explained the results in the short-run. Now explain what will result in the long-run. What will the price of oranges be when long-run equilibrium is reached?

### Practice Quiz for Classes 11 and 12

1. If the **marginal revenue is greater than the marginal cost**, a profit maximizing company should
  - a. produce more
  - b. produce less
  - c. stop producing, because it is producing just the right amount
2. A profit maximizing company will produce up to the quantity for which
  - a. the marginal revenue exceeds the marginal cost by the greatest amount
  - b. the variable cost equals the fixed cost
  - c. the marginal revenue equals the marginal cost
  - d. the marginal revenue equals the price
3. In perfect competition, the price
  - a. is greater than the marginal revenue
  - b. is less than the marginal revenue
  - c. equals the marginal revenue
4. If a company is making **economic losses**, in the short-run, it should continue to produce as long as the total revenue is greater than the
  - a. total cost
  - b. fixed cost
  - c. variable cost
  - d. marginal cost
5. The **short-run supply curve for one seller** is its
 

a. marginal cost above the variable cost	c. marginal revenue above marginal cost
b. average total cost above marginal cost	d. average total cost above average fixed cost
6. **Long-run equilibrium** occurs when:
 

a. Marginal revenue equals marginal cost	c. New firms enter the industry
b. Economic profits are at their maximum	d. Economic profits are zero

Answers: 1. A 2. C 3. C 4. C 5. A 6. D