Review Answers

Part I. Economic Terms and Concepts; Production Possibilities

1. Macroeconomics and microeconomics differ in broadness of viewpoint and also in what is held constant. In economic terms, they differ according to the level of consolidation and the treatment of systematic influences.

   Microeconomics studies particular markets and the behavior of individual decisionmakers (consumers, firms, resource owners, government, non-profit agencies). Macroeconomics studies overall markets and the collective behavior of many decisionmakers at once. Microeconomics is not concerned with system-wide influences, which are held constant while we focus on specific parts of the economy. Systematic influences are very important in macroeconomics, which holds nothing constant and is concerned with how the entire economy is interrelated.

   In microeconomics, we might examine unemployment in a particular geographic area, price changes in a single firm or industry, household income allocation, and the distribution of income. In macroeconomics, we study the measurement and determination of Gross Domestic Product (national output and national income), national unemployment, and the national rate of inflation.

2. The Fallacy of Composition is the mistake of assuming that what is true in one specific instance (micro) is also valid for the sum total (macro), or vice versa. Composite economic behavior is not the same as the simple summation of individual activities, due to systematic influences.

   1) Economy-wide inflation vs. price increases in one firm or industry; 2) national unemployment vs. individual difficulties in finding a job; 3) wage changes in the economy as a whole (which affect income) vs. wage changes in a single firm (which have little effect on average or national income); 4) national borrowing vs. private borrowing from the future; 5) national saving vs. individual saving (Paradox of Thrift); 6) categorizing money as "wealth".

   The Fallacy of Composition exists because what is true for an individual economic decisionmaker is true only if other things remain constant. Many similar economic decisionmakers acting the same way at the same time will affect economy-wide (systematic) variables, which then have feedback effects on the individual decisionmakers.

3. Positive:
   1) An increase in supply should cause price to decrease.
   2) If price falls, quantity demanded will increase.
   3) The rate of unemployment in the U.S. in 1985 was 6.9%.
   4) An increase in natural resources will increase production possibilities.
   5) The federal budget will be balanced by 2005.
   6) An increase in demand causes price to fall.

Normative:
   7) Low-income households would have been better off if another President had been elected.
   8) Wage and price controls are more equitable (fair) than continued inflation.
   9) Defense spending is more important than social programs.
   10) Minorities deserve better educational opportunities.
   11) Economics teachers should be paid higher salaries.
   12) Abortions should be outlawed.

Positive statements are not always true (see #6). Normative statements often contain the word "should" (see #11 and #12), but positive statements may also use that word (see #1). Positive statements are based on objective facts and can eventually be proven to be true or false. Normative statements are based on subjective value judgments (opinions), and can never be proven to be right or wrong.
4. Both normative and positive economics are important in centralized (government, public sector) decisionmaking and in individual decisionmaking. Our goals are based on values and opinions, therefore are normative. Positive economics can tell us whether our chosen goals are feasible, and what actions may lead us closer to those goals.

5. Models are theories used to abstract from the details of a real situation and to focus on the major variables affecting what we are trying to analyze. Models are designed to simplify and make predictions. Therefore, a model should be judged on the basis of its predictive capacity, rather than on the realism of its assumptions. A good model predicts well.

6. Stock variables are those which are measured at a point in time: labor force, public (national) debt, money supply, capital stock, wealth.

7. Flow variables are those which can only be measured over a period of time: output, income, consumption, investment, saving. The time period over which a flow variable is measured is extremely important to its meaning ($1000 per year vs. $1000 per week).

8. Opportunity cost is the highest-valued alternative forgone when a choice is made. It is measured in terms of real goods and services, not in dollars.

   One of the primary costs of education is often the time spent and earnings forgone. The opportunity cost of an interstate highway system might be the system of national libraries that could have been built instead, using the same resources. The opportunity cost of going to a movie might be the football game you could have attended instead. The opportunity cost of producing an Army tank might be the 5 consumer cars that could have been produced instead. The opportunity cost of investing in a project is the highest-valued alternative use of your resources.

9. Expectations are important because decisionmakers act based on their expectations. Much of economics is designed to predict behavior. Our economy is very sensitive to expectations, which in the macroeconomy tend to be self-fulfilling. When decisionmakers expect something to happen, they take actions to protect or benefit themselves. If enough decisionmakers expect the same thing at the same time, those actions are likely to turn the expectation into reality. Examples are widespread expectations of price changes, shortages, and surpluses.

10. Scarcity means that there are never enough resources to satisfy all wants. This is partly because nature supplies resources in limited quantities, but also because human wants tend to be insatiable (unlimited), especially in the aggregate. Scarcity does not mean poverty. Scarcity exists even in wealthy nations and even in wealthy households.

11. Choices must be made because of scarcity. Limited resources force choices among alternatives. Choice implies opportunity cost. Decisionmakers cannot avoid making choices. Deciding not to choose is a choice.

12. Attempts to solve one economic problem may worsen another economic problem. Attempts to achieve one objective may make it more difficult to achieve another desirable objective.

   Policies to reduce inflation may worsen unemployment and/or reduce GDP. Policies to increase national production may increase pollution and/or congestion. Attempts by a firm to reduce input costs by moving the firm closer to the sites of its resources may decrease the demand for the output produced by moving the firm farther from its market area and increasing transportation costs for the finished product. Attempts to earn more money may decrease the leisure time in which to enjoy that additional income. Taking classes to increase future earning power may cause a lower standard of living right now.

13. Factors of production are the resources used to produce commodities (goods and services). They are called factors, resources, or inputs.

   1) Land: all natural resources, including acreage, fertility, rivers, minerals, forests, and air.
   2) Labor: human resources, including physical and mental labor, education, training, talent, and skills.
   3) Capital: manufactured (man-made) resources, which are outputs to some firms and inputs to others, including buildings, machines, and tools.
   4) Entrepreneurship: human resources used to assemble other inputs, organize them, manage the production process, invent new technology and new products, experiment, and take business risks.
A. Assumptions: 1) the economy produces only two goods; 2) there are fixed amounts of resources available; 3) the technology available is also constant.

B. The fact that some combinations of goods are unattainable (such as 6 million tons of food and 6000 tractors) illustrates scarcity.

C. Because of scarcity, choices must be made in the allocation of resources. From a point on the curve (efficient production with full employment of all resources), if we want more of one good we must divert resources from the production of the other good. The opportunity cost of additional tractors is the food which could have been produced instead. Opportunity cost is NOT usually constant! The more of one good the nation is currently producing, the greater the opportunity cost of producing even more of that commodity.

D. This positive model shows us which combinations of outputs are feasible. Normative decisions determine WHERE on the production possibilities curve an economy will produce. A movement along the curve would indicate a reallocation of resources, and a choice to change the combination of outputs produced.

E. Points outside the production possibilities curve are not currently attainable, given society's resources and technology (scarcity).

F. A movement from a point on the curve to a point inside the curve would indicate that resources are no longer being used fully and efficiently. Unemployment of resources or inefficient use of technology (or both) have increased in the economy. To move back to a position on the curve, inefficiency and unemployment would have to be eliminated.

G. The position of the curve is determined by the available resources and technology. The curve would shift outwards (an increase in production possibilities, or economic growth) if more resources were discovered, developed, or created, or if technology improved. The curve would shift inwards if resources were depleted or destroyed, or if technology regressed.

H. The shape of the curve is usually bowed outwards due to the Law of Increasing (Opportunity) Costs. More and more tons of food must be given up in order to achieve equal successive increases in tractors produced per time period. Similarly, more and more tractors must be given up to achieve equal successive increases in food production per time period.

The Law of Increasing Costs exists because some resources are specialized and because of diminishing marginal productivity (diminishing returns). Some resources are better adapted to producing one good than the other. As resources shift from food production to tractor production, the inputs best adapted to producing tractors are moved first. These inputs were not very efficient at producing food, so not a lot of food is given up at first. As more and more tractors are produced, inputs which are specialized in food production begin to be reallocated to tractor production. These inputs, which are very productive in the food industry, are not as productive in the tractor industry. Diminishing marginal productivity (diminishing returns) means that, as long as at least one input is fixed in supply, adding more and more of another input to the production of a commodity will eventually result in smaller and smaller increases in the output of the commodity.

If all resources were equally suitable for all production purposes (or at least the two being graphed), the production possibilities curve might be a straight line. If the two commodities are wheat and oats (which use very similar resources), the production possibilities curve could be a straight line. The more specialized resources are, the more bowed the curve will be.

15. The product market is where final goods and services are exchanged (bought and sold). Firms are the primary sellers and households are the primary buyers. Government and the foreign sector may participate in product markets as buyers or sellers.

16. The factor market (also called the resource market or the input market) is where resources are exchanged. Households, as the ultimate owners of most resources, are the primary sellers and firms are the primary buyers. Government and the foreign sector may participate in factor markets as buyers or sellers.
17. All societies face the problem of scarcity and must find ways to answer the basic economic questions: What should be produced, and in what quantities? How is each commodity to be produced (how should we allocate our scarce resources)? How are the commodities produced to be distributed among the members of society?

Traditional economies are dictated by customs. They do the same things in the same ways that they were done in the past.

Free-market economies rely on decentralized decisionmaking in free markets to determine the allocation of resources and the distribution of output/income. Characteristics include private ownership of capital and other resources (the means of production), freedom of choice (in working, purchasing, producing, and other economic activities), economic competition among similar decisionmakers, and resources and commodities are sold in markets for prices.

Command economies use central planning to decide upon resource allocation and the distribution of output/income. Capital and other resources are owned by the state (the government), decisionmakers (consumers, producers, resource owners) have less freedom of choice, competition is more political than economic, and markets and prices are not required (though they may be used).

Real economies generally contain elements of all three economic types, and are called "mixed" economies. The U.S. does not have a purely free-market economy. There is a large and powerful central government which makes many decisions collectively and limits our freedom of choice. The government owns or controls many of our resources. There is political, as well as economic, competition. Some parts of our economy are not competitive, and individuals, groups, and firms have developed strong market power.

18. The public sector corresponds to the command elements in a mixed economy, with centralized decisionmaking by the government. The private sector corresponds to the free-market elements in a mixed economy, with decentralized decisionmaking by households and firms.

Part II. Supply and Demand

19. The price system is extremely important in an economy with free-market elements. It coordinates individual, decentralized decisionmaking by acting as a set of signals (source of information) reflecting changes in supply and demand. Although economic decisionmakers respond to prices individually, the pricing mechanism enables these reactions to occur in a coordinated manner. Market prices give economic decisionmakers important information. The price system works well in many cases, because it is based on self-interest.

The price system answers the three basic economic questions:

1) What should be produced?
The price system creates incentives (prices, profits) for firms to produce what buyers want, and in the quantities that they want. Firms that pay attention to buyers' desires tend to be more profitable than firms which ignore buyers' desires.

2) How should each commodity be produced? (Which resources should be used to produce which commodities?)
Individual producers choose the least expensive methods of production according to input prices, which reflect the resource's scarcity and opportunity cost (value in alternative uses). Resources tend to be allocated where they are most highly valued. The price system encourages producers to use abundant resources (because they are inexpensive) and to economize on the use of scarce resources (because they have higher prices).

THE PRICE SYSTEM ALLOCATES SCARCE RESOURCES.

3) How should the output be distributed? Who gets the commodities produced?
Goods and services are distributed according to freedom of choice, limited by income. The initial distribution of resources determines resource prices and the distribution of income. Do you have many resources, and are they scarce and valuable (property, capital, highly educated and trained labor)? Do you have only a few resources that are relatively abundant, like unskilled labor? The price system rations the available supplies of goods and services among the many demanders. Who gets the goods? Whoever is willing and able to pay the price.

THE PRICE SYSTEM RATIONS SCARCE GOODS AND SERVICES.

The price system usually leads to efficiency in production and distribution. It enables an economy to function with decentralized decisionmaking, which maximizes freedom of choice. It can stimulate economic growth through specialization, division of labor, and the incentives of self-interest.
Problems with the price system:
1) The price system fails to adequately provide for public goods and services. The government (public sector) may tax citizens and provide these commodities.
2) The price system results in a distribution of income which is very unequal. If we do not like this distribution, we can ask the government to redistribute income according to our normative desires, using taxes and transfer payments.
3) Externalities, like pollution, occur when some of the costs of production are not paid by the producer. The price system may give incorrect information and create incorrect incentives. Government may try to correct this through regulation, taxation, pollution fees, and other measures.
4) Some markets are not competitive (monopoly), and the proper functioning of the price system is based on competition. Government may try to correct this through regulation or antitrust (breaking up monopolies).

While government actions are the solutions to these problems with the price system, it is important to remember that government intervention in free markets will affect the information disseminated through the price system and will affect the incentives created in those markets. Unintended and undesirable results may occur, especially if government intervention is continued for long periods of time.

20. A barter economy is one alternative to a price system. In a barter economy, goods and services are exchanged directly. The barter system has many disadvantages, compared to a price system. It is dependent on the "double coincidence of wants". I not only have to find someone who has and is willing to trade what I want, but that person must also want what I have to trade. It is time-consuming and difficult to match people who want to make appropriate exchanges. It is also time-consuming and difficult to haggle over the exchange rate (what is your good worth in terms of my good) every time a transaction is made. Money facilitates exchange, reduces transactions costs, and encourages specialization and economic growth.

A second alternative to a price system is a purely command economy. A price system is not needed to allocate resources, direct production, and distribute output/income when there is a king, dictator, or central planning agency making all the decisions. However, the decisionmakers must have accurate and complete information to make certain the economy operates smoothly.

21. "Quantity demanded" indicates a point on the demand curve, a price-quantity combination. "Demand" indicates the entire demand curve, the complete relationship between price and quantity demanded. A change in price due to a shift in the supply curve will cause a change in "quantity demanded" (movement along the demand curve), but no change in "demand" (shift of the entire demand curve).

If buyers purchase more BECAUSE THE PRICE DECREASED, quantity demanded has changed with no change in demand. The entire demand curve has shifted to the right. We move from one row in our table of the demand schedule to another row in the same table, with no change in the overall relationship (no changes in the numbers in the table). We move from one point on the demand curve to another point on the same demand curve.

If buyers purchase more AT EVERY PRICE, demand has increased. The numbers in the quantity demanded column of our demand schedule all change. The entire demand curve has shifted to the right. A change in "demand" is caused by changes in tastes, income, population, distribution of income, expectations, and prices of related goods, BUT NOT BY CHANGES IN THE PRICE OF THE GOOD ITSELF.

There is the same distinction between "quantity supplied" and "supply". A change in "supply" is caused by changes in firms’ goals, technology, number of sellers, factor prices (costs), expectations, and prices of related goods, BUT NOT BY CHANGES IN THE PRICE OF THE GOOD ITSELF. A movement along a given supply curve, caused by a change in the price of the good, is called a change in "quantity supplied". A change in "supply" refers to a shift in the supply curve (firms are willing to sell more or less AT EVERY PRICE).

22. A. Substitutes in consumption are goods that satisfy similar needs or desires, goods which are USED in place of each other. Examples: butter and margarine, pens and pencils, telephone calls and letters, cars and bicycles.

B. Complements in consumption are goods which tend to be USED together. Examples: hot dogs and hot dog buns, pen and paper, cassettes and cassette players.

C. Substitutes in production are goods which tend to be PRODUCED in place of each other, using the same resources. Examples: coffins and cabinets, tires and tennis balls.

D. Complements in production are goods which tend to be PRODUCED together, often one is a byproduct of the other. Examples: beef and leather, skim milk and cream, oil and gas.
23. The direct (short-run) effects would likely be:
   A. Demand increases.
   B. No change in Demand.
   C. No change in Demand, unless the product quality or design changes.
   D. Demand increases for normal goods.
   E. Demand increases.
   F. Demand may increase, due to the increase in average income, but the effect depends on the tastes of various income classes and the magnitude of the decline in population.
   G. NO CHANGE IN DEMAND!!!
   H. Demand decreases.
   I. No change in Demand.
   J. No change in Demand.
   K. No change in Demand.
   L. Demand increases.
   M. Demand increases, but the effect depends on whether the good is inferior or normal, necessity or luxury.
   N. No change in Demand.
   O. Demand increases.
   P. No change in Demand.
   Q. No change in Demand.

24. The direct (short-run) effects would likely be:
   A. No change in Supply.
   B. Supply decreases.
   C. Supply usually increases (unless the change in technology makes the product obsolete).
   D. No change in Supply.
   E. No change in Supply.
   F. No change in Supply.
   G. NO CHANGE IN SUPPLY!!!
   H. No change in Supply.
   I. Supply decreases.
   J. Supply increases.
   K. Supply decreases (internalizing the externality).
   L. No change in Supply.
   M. No change in Supply.
   N. Current Supply may decrease, in anticipation of lower input prices at a later date.
   O. No change in Supply.
   P. Sellers (who expect price to drop in the future) may cut back on production now and try to leave the industry in the long run; or they may try to sell more now to eliminate inventory.
   Q. Supply decreases.

25. The entire supply curve shifts to the right. It does not shift "up".

26. Equilibrium is a stable situation, with no tendency for change to occur. No decisionmaker has an incentive to change behavior. It is a situation that can persist. A market is in equilibrium when quantity demanded equals quantity supplied at the current market price. An equilibrium price is a price that can be maintained until either supply or demand changes.

27. Excess demand (shortage) puts upward pressure on price. Excess supply (surplus) puts downward pressure on price.

28. A. An increase in supply causes equilibrium price to fall and equilibrium quantity to increase.
   B. A decrease in supply causes equilibrium price to rise and equilibrium quantity to decrease.
   C. An increase in demand causes equilibrium price and equilibrium quantity both to rise.
   D. A decrease in demand causes equilibrium price and equilibrium quantity both to decrease.
29. Actual prices tend to move toward equilibrium prices. If market conditions remain stable for a time, the actual price should eventually equal the equilibrium price. However, the movement of actual price toward equilibrium price is not always rapid, especially when the equilibrium price is lower than the current price. In the real world, variables change so frequently that by the time actual price approaches equilibrium price, market conditions have changed and there is a new equilibrium price. Economists generally assume that the actual price in a free market will approximate the equilibrium price. For many purposes, it is enough to correctly predict the direction in which price is likely to move.

30. A price ceiling is a legal maximum price. A price ceiling set above the equilibrium price has no effect on the market. A price ceiling set below the equilibrium price creates a shortage (excess demand). There may be waiting lists, long lines, discrimination (sellers have the power to decide who gets the scarce good), government rationing, and/or black markets. Rent controls are real world price ceilings. Rent controls may create shortages of (rent-controlled) housing, deterioration of rent controlled buildings, possible discrimination by landlords, and black markets.

31. A price floor is a legal minimum price. A price floor set below the equilibrium price has no effect on the market. A price floor set above the equilibrium price creates a surplus. Agricultural price supports are price floors which create surpluses (rising inventories of goods that cannot legally be sold). The government often purchases the surplus or attempts to find inventive ways to reduce the surplus (paying farmers for NOT producing, for example). The minimum wage is a price floor in a factor market. It increases the income of minimum-wage workers who are lucky enough to find or keep their jobs, but it also reduces employment of these workers and creates a surplus of such labor (unemployment).

Part III. Elasticity

32. Elasticity measures the sensitivity (responsiveness) of quantity demanded or quantity supplied to changes in price or other economic variables. We know that if price increases, quantity demanded falls and quantity supplied increases, but elasticity tells us how much they will change. Elasticity can explain what will happen to a firm's revenue, a consumer's expenditures, workers' salaries, and farm incomes, when prices change.

33. Price elasticity of demand is the percentage change in quantity demanded divided by the percentage change in price. It tells us how responsive quantity demanded is to changes in price.

\[
\text{Price elasticity of demand} = \frac{-\frac{\text{change in quantity demanded}}{\text{average quantity demanded}}}{\frac{\text{change in price}}{\text{average price}}}.
\]

We use average price and average quantity because we want our calculation of price elasticity of demand between two points on a demand curve to be independent of whether we are moving from A to B or from B to A (whether price is rising or falling).

34. Slope tells us the absolute change along the curve, and is seen as the steepness of the curve.

\[
\text{slope} = \frac{\text{change in price}}{\text{change in quantity}}.
\]

Two points on a demand curve are (price, quantity demanded): ($5, 1) and ($3, 3). The slope of this demand curve is \(-1\), but its elasticity is 2.

A vertical demand curve is perfectly inelastic (elasticity = 0). A horizontal demand curve is perfectly elastic (elasticity is infinite). Consumers do not have perfectly elastic demand curves for commodities, but the demand curves facing many firms may be perfectly elastic. If two demand curves are drawn on the same graph (or at least on the same scale), we can make comparisons of their relative elasticities (the steeper one is less elastic). Otherwise, it is not possible to determine price elasticity of demand by simply looking at the graph.

35. Perfectly Inelastic \( \eta = 0 \)

Inelastic \( 0 < \eta < 1 \)

Unit elastic \( \eta = 1 \)

Elastic \( 1 < \eta < \text{infinite} \)

Perfectly Elastic \( \eta = \text{infinity} \)
36. If demand is elastic, price will drop slightly and quantity will increase greatly. If demand is inelastic, price will decrease greatly and quantity will increase slightly.

37. If demand is elastic, price will increase slightly and quantity will decrease greatly. Buyers induce sellers to keep prices low by buying much less.
   If demand is inelastic, price will increase greatly and quantity will decrease slightly. Buyers induce sellers to provide almost as much output as before, by their willingness to pay a higher price.

38. Demand curves have a negative slope (there is an inverse relationship between price and quantity demanded). By convention, a negative sign in the formula for price elasticity of demand makes demand elasticity positive.

39. A straight-line demand curve has constant slope, but its elasticity varies along the curve (unless it is horizontal or vertical). A straight-line, downward-sloping demand curve is more elastic at higher prices and less elastic at lower prices.

40. A) Number and closeness of available substitutes in consumption (which depends in part on how narrowly the good is defined). More substitutes and closer substitutes make demand more elastic. Example: Huggies disposable diapers (elastic), disposable diapers (less elastic), diapers (least elastic). Beef (elastic), meat (less elastic), food (least elastic). Salem cigarettes (elastic), cigarettes (less elastic), tobacco products (least elastic).
   B) Importance of the good in consumers’ budgets. Items which involve a significant expenditure in relation to income usually involve more “shopping around” (more elastic). Example: washing machine (elastic), laundry soap (less elastic), disposable pen (very inelastic).
   C. Length of time involved. Demand is more price elastic, the longer the time period. For example, if the price of natural gas increases, there will be little immediate decrease in quantity demanded (inelastic in the short run), since households and firms are temporarily locked into their energy decisions. Over a longer period of time, they can adapt, look for alternate energy sources, and encourage the development of new energy sources.

41. When demand is ELASTIC, total revenue/expenditure increases as price falls and decreases as price rises. When demand is UNIT ELASTIC, small price changes have no effect on total revenue/expenditure. When demand is INELASTIC, total revenue/expenditure decreases as price falls and increases as price rises.

42. Income elasticity of demand is the percentage change in quantity demanded resulting from a 1% change in income, all prices and other factors being held constant.
   \[
   \text{Income elasticity of demand} = \frac{\text{change in quantity demanded}}{\text{change in income}} \times \frac{\text{average income}}{\text{average quantity demanded}}
   \]
   Income elasticity of demand is negative for inferior goods. If income increases, quantity demanded decreases as buyers switch to better-quality goods. Normal goods have positive income elasticity of demand.

43. Luxuries have high income elasticity of demand (as income increases, the quantity demanded increases by a large percentage). Necessities have low income elasticity of demand (as income increases, the quantity demanded increases by a small percentage). Since necessities are “required”, they will be purchased even if income is low, and as income increases the requirement for a necessity is already satisfied and little of the income increase is spent on the necessity.
   Luxuries also often have high price elasticity of demand, since their purchase can be forgone if their prices rise too high. Necessities frequently have low price elasticity of demand, since they are “required” regardless of price.
44. Cross elasticity of demand described the percentage change in the quantity demanded of one good in response to a 1% change in the price of another good. Positive cross elasticity of demand indicates that the two goods are substitutes in consumption (as the price of A increases, people buy more B). Negative cross elasticity of demand indicates that the two goods are complements in consumption (as the price of A increases, people buy less A and less B). Goods that are unrelated tend to have a cross elasticity close to zero, but sometimes it will be a small negative number due to the income effect (a price increase reduces real income and therefore less is demanded of all normal goods).

45. Price elasticity of supply describes the percentage change in quantity supplied in response to a 1% change in its price.

\[
\text{Price elasticity of demand} = \frac{\text{change in quantity supplied}}{\text{average price}} \times \frac{\text{change in price}}{\text{average quantity supplied}}
\]

You can determine the elasticity of a vertical or horizontal supply curve (see #44). If the supply curve is a straight line, you can also determine the general elasticity (inelastic, elastic, unit elastic) by observing whether the line intersects the vertical axis, the horizontal axis, or the origin.

46. A vertical supply curve is perfectly inelastic (elasticity = 0). There is a fixed supply, regardless of price (seats in an airplane or theater, Rembrandt paintings). A horizontal supply curve is perfectly elastic (elasticity is infinite). Firms do not have horizontal supply curves, but long-run industry supply curves and the supply curves facing consumers may be perfectly elastic (you can buy as much as you like at the going price, but the product is not available at a lower price).

47. Price elasticity of supply depends largely on the behavior of costs as output is varied. A rise in the price of a firm's product creates an incentive for the firm to produce more (increase quantity supplied). If production costs increase rapidly as the firm produces more output, the price increase will cause a smaller increase in quantity supplied than if costs increase very slowly with increasing output.

The length of the time period is also important in determining price elasticity of supply. The longer the time period, the more elastic the supply curve (more time to find cheaper inputs or alternative production processes, more time to adapt and respond to price signals).

Part IV. Household Consumption Behavior and Rational Choice

48. Utility is satisfaction or welfare. Households attempt to maximize their utility subject to their limited income. Society often puts legal restraints on households’ utility maximization, and there may be social constraints as well.

49. Total utility is the total satisfaction obtained from consuming a commodity or commodities. Marginal utility is the CHANGE IN satisfaction from consuming ONE UNIT more or less of a commodity.

Real choices are rarely determined by total utilities. Most choices involve consuming a little more or a little less of some commodity (marginal utility), rather than being all-or-nothing alternatives.

50. The Law of Diminishing Marginal Utility: After a certain point has been reached, the utility that a household derives from successive units of a commodity during a given time period will diminish as total consumption of the commodity increases, ceteris paribus (holding constant the consumption of all other goods). In other words, after you have consumed a certain number of units of the commodity within a given time period, each ADDITIONAL unit of the commodity will give you less and less ADDITIONAL satisfaction (marginal utility for the commodity falls). This Law does not mean that you derive less and less total utility as you consume more of a good (although that could happen in an extreme situation, where marginal utility is negative). As long as marginal utility is positive (even if it is decreasing), total utility is increasing with increased consumption of the commodity.

Utility is not measurable in the sense that a person’s weight can be measured. Utility can be ranked (most satisfaction, second-most satisfaction, … least satisfaction), but it cannot be used to compare the satisfaction of two or more different people, since it is so subjective.
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51. Yes, negative marginal utility means that increasing consumption of the good is actually reducing your total satisfaction. No consumer would make a rational choice to consume so much of a good in a given time period that its marginal utility would be negative. Sometimes we make mistakes, though, and due to incomplete information or poor judgment consume a good to the point at which its marginal utility is negative.

52. \[
\frac{MU(X)}{P(X)} = \frac{MU(Y)}{P(Y)}
\]

for ALL goods X and Y

Different commodities have different prices, representing different opportunity costs. We are not only concerned with the satisfaction we get from each good purchased, but also with its price. “Dollars” are our unit of comparison.

If the marginal utilities of two goods are equal, but the price of one good is $1 per unit and the price of the other is $100 per unit, the consumer can increase his/her total utility by buying one less unit of the high-priced good (thereby saving $100) and using the money to buy up to 100 units of the low-priced good. The first additional unit of the low-priced good will give you as much satisfaction as the single unit of the high-priced good you gave up (by definition, since their marginal utilities are equal), and the other additional 99 units of the low-priced good will increase your total satisfaction above what it was before.

Consumers maximize utility by consuming goods in quantities such that the marginal utility PER DOLLAR is equal for every commodity consumed. If it costs twice as much, it must give you twice as much additional satisfaction for you to purchase it.

53. \[
\frac{MU(X)}{P(X)} < \frac{MU(Y)}{P(Y)}
\]

Starting from equilibrium (maximizing total utility), if the price of Good Y falls, the consumer will be facing the situation at left.

Consumers usually have no control over the prices of the goods they buy, but they can control their marginal utilities by buying more or less of the good (due to the Law of Diminishing Marginal Utility). This household should reallocate its spending away from Good X and purchase more of Good Y. As it buys less X, the marginal utility from consuming X will increase (bringing the household closer to equilibrium). As it buys more Y, the marginal utility from consuming Y will decrease (bringing the household closer to equilibrium). When the price of Good Y decreases, the household can increase its total utility by buying more Y and less X.

54. As income increases, relative prices have not changed but the household will tend to purchase more of all normal goods. For this reason (and the Law of Diminishing Marginal Utility), equilibrium marginal utilities will be lower than before. Total utility, however, will have increased.

Because of the Law of Diminishing Marginal Utility, lower marginal utilities indicate greater total utility due to greater consumption of the goods (as long as tastes have not changed). Graphically, total utility is the area under the marginal utility curve… which is greater when marginal utility is lower (as long as it is not negative).
55. As long as an additional unit consumed has a positive marginal utility, total utility will be increased by consuming more of the commodity. Therefore, the consumption of any free good (price is zero) will be increased to the point at which its marginal utility is zero and total utility is maximized. Consumers do not generally want unlimited or infinite amounts of any commodity within a given time period.

56. Using the concepts of “income effect”, “substitution effect”, and “diminishing marginal utility”, explain why most demand curves slope downwards from left to right.

57. Yes, a market demand curve is the horizontal sum of the demand curves of all the buyers in the market. Market demand cannot be estimated by summing the demands for the individual brands of the general product. The demand curves for individual brands are calculated/drawn assuming that the prices of all other brands remain constant. The overall market demand for the general product is calculated/drawn assuming that the prices of all brands change at the same time. Thus, the demand curves for individual brands are likely to be much more elastic than the market demand curve for the general product.

   In other words, the market demand for soft drinks is the demand for soft drinks by each of the individual buyers (my demand plus your demand plus everyone else’s demand). It is NOT the demand for Coca-Cola, plus the demand for Pepsi, plus the demand for Sprite, plus the demand for Mountain Dew… etc.

58. What is the Paradox of Value? Why does it exist?

59. How is price elasticity of demand related to marginal utility? How is price elasticity of demand related to total utility?

Part V. Theory of the Firm

60. Suppliers must decide how much output they should produce per time period (output is a flow) and they must determine the most efficient method of producing that output. Some suppliers must accept the price that results in the free market, while other suppliers have some control over price and must make that decision as well.

   In the short run, suppliers must decide how best to utilize existing plant and equipment. In the long run, they must decide whether to change or replace plant and equipment, relocate, and expand or contract their operations. In an even longer time frame (sometimes called the “very long run”), they must decide whether to devote time and other resources to research and the development of new methods of production. The decisions during the various time periods all relate to the problem of using inputs to produce output. The difference between these decisions involves which variables the firm is able to change.

61. We assume PROFIT MAXIMIZATION. This simplifies the real situation, where there may be other goals (political influence, increasing market share, improving community relations, protecting the environment) and where groups within firms may have their own motivations. Also, there may be risks and uncertainty involved. A firm may forgo some profit to avoid a certain amount of risk. Firms may not always be certain which actions will lead to the greatest profit.

   Our assumption does not imply that profit is the ONLY influence on firms. Models must simplify to be useful. Profit is an important consideration for most firms, and we can make fairly accurate predictions of firm behavior by observing profit alternatives. Even if a firm does not maximize profit, our economic theory can indicate the opportunity cost of the actions actually taken (profit forgone).

62. Technology is represented by the production function in our models. Due to the close relationship between productivity and costs, technology also affects the cost curves.

63. Factors of production can be combined in various ways to produce output. A labor-intensive production process uses a lot of labor. A capital-intensive production process uses a lot of capital (often highly automated and mechanized).
64. A technologically efficient production process uses the fewest inputs to produce a given amount of output. (Alternatively, a technologically efficient production process produces the most output for given amounts of inputs.) There may not be ONE “most technologically efficient” production process, because quantities of different inputs are not comparable (one unit of labor is not the same as one unit of capital).

To determine technological efficiency, each production process must be compared to every other production process. A process is technologically INEFFICIENT only if it unequivocally uses more inputs. If a production process uses more of one input and less of another input, both processes being compared are technologically efficient. A technologically inefficient production process wastes inputs.

Number of units of inputs required to produce 100 units of output, using various production processes:

<table>
<thead>
<tr>
<th>Method</th>
<th>Capital</th>
<th>Labor</th>
<th>Raw Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>50</td>
<td>400</td>
<td>150</td>
</tr>
<tr>
<td>B</td>
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<td>E</td>
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<td>150</td>
</tr>
<tr>
<td>F</td>
<td>20</td>
<td>600</td>
<td>200</td>
</tr>
</tbody>
</table>

A & B: A uses less labor and more raw material. BOTH EFFICIENT.
A & C: A uses more capital and labor, but less raw material. BOTH EFFICIENT.
A & D: A uses more capital and raw material, but less labor. BOTH EFFICIENT.
A & E: A uses more capital and less labor. BOTH EFFICIENT.
A & F: A uses more capital, but less labor and raw material. BOTH EFFICIENT.
B & C: B uses more capital and labor, but less raw material. BOTH EFFICIENT.
B & D: B uses more capital and the same amounts of labor and raw materials.

B IS TECHNOLOGICALLY INEFFICIENT. B wastes capital, and a firm would not choose method B as long as method D is available. We do not need to do any further comparisons with method B, since it is technologically inefficient.

B & E: B uses more capital, but less labor and raw material. BOTH EFFICIENT.
B & F: B uses more capital and labor, but less raw material. BOTH EFFICIENT.
C & D: C uses more capital and raw material, but less labor. BOTH EFFICIENT.
C & E: C uses more capital and raw material, but less labor. BOTH EFFICIENT.
C & F: C uses more capital and raw material, but less labor. BOTH EFFICIENT.
D & E: D uses less raw material and the same amounts of capital and labor.

E IS TECHNOLOGICALLY INEFFICIENT. E wastes raw material, and a firm would not choose method E as long as method D is available. We do not need to do any further comparisons with method E, since it is technologically inefficient.

D & F: D uses more capital, but less raw material. BOTH EFFICIENT.

Conclusion: Methods A, C, D, and F are all technologically efficient. Methods B and E are technologically inefficient.

Method G (25 capital, 500 labor, and 100 raw material) is technologically efficient. This new process G makes method D technologically inefficient (methods B and E remain technologically inefficient). Firms would choose between methods A, C, F, and G.

Method G (25 capital, 400 labor, and 100 raw material) is technologically efficient. This new process G makes methods A and D both technologically inefficient (methods B and E remain technologically inefficient). Firms would choose between methods C, F, and G.

65. The most economically efficient method of production is the one that produces a given amount of output at the lowest cost. (Alternatively, the most economically efficient method of production is the one that produces the most output for a given cost.) Economic efficiency is determined by INPUT PRICES, as well as the quantities of inputs used. Technological efficiency is concerned only with input quantities.

As long as inputs are not given away for free, a technologically inefficient production process can never be economically efficient. A technologically inefficient production process uses more resources, which cost money. Therefore, it could never be the least expensive method of production. This is asking whether a method which wastes resources can be the cheapest way to produce the product (it cannot).
Yes, a technologically efficient production process could be economically inefficient, depending on resource prices. Suppose in the table of processes A through F the price of capital is $6, the price of labor is $1, and the price of raw material is $2. Methods A, C, D, and F are still all technologically efficient. Method A costs $1000, method B costs $1100, method C costs $1040, method D costs $980, method E costs $1080, and method F costs $1120. Method D is economically efficient. Methods A, C, and F are all technologically efficient, but economically inefficient, given these input prices. They cost more to produce 100 units of output, not because they waste resources but because they use a lot of resources that happen to be expensive.

Usually economical efficiency narrows the choice to one lowest-cost method. However, it is possible for more than one process to be economically efficient (again, it depends on input prices). Suppose in the table of processes A through F the price of capital is $30, the price of labor is $5, and the price of raw material is $8. Method A costs $4700, method B costs $5300, method C costs $4700, method D costs $4700, method E costs $5100, and method F costs $5200. Methods A, C, and D are all economically efficient.

Notice that methods B and E will always cost more than method D.

66. If a payment is actually made to a supplier, worker, or other resource owner, it is an explicit cost which is easily measured. If a resource is owned by the firm owner (labor and entrepreneurial talents, capital assets like buildings and machines, land, raw materials), there may be no explicit payment for that resource. Nevertheless, these resources do have alternative uses and opportunity costs. The costs of such unpaid owner-supplied resources are implicit costs, which must be estimated. Opportunity cost is the highest-valued opportunity forgone by pursuing a particular course of action. For a resource, opportunity cost is its value in its best alternative use.

67. Economic profit on the sale of a commodity is the difference between total revenue received and the opportunity cost of ALL the resources used to produce the commodity (both implicit and explicit costs). Profit is total revenue minus total cost.

Zero economic profit means that enough revenue is generated through the sale of the product that ALL resources could be paid as much as their value in their next best alternative use. The firm is performing satisfactorily and should neither shut down nor leave the industry. Zero economic profit is the same as what an accountant would call a “normal rate of return”.

Economic profits and losses are important in determining the allocation of resources. Positive economic profit indicates greater potential earnings in that industry than in alternative uses. Resource owners want to move their resources into industries earning positive economic profit. Negative economic profit (economic loss) indicates that resources would be better paid elsewhere. Resource owners have an incentive to move their resources out of industries earning negative economic profit into more profitable uses.

If resources are allowed to move freely between industries (there are no “barriers to entry”), long-run equilibrium exists only when resource owners have no incentive to move their resources from one industry to another. In ANY market structure where there is freedom of entry and exit (minimal barriers to entry and exit), long-run equilibrium occurs only when economic profit is zero. In other words, long-run equilibrium in competitive industries exists only when economic profit is zero.

68. Fixed inputs are resources whose quantities cannot be changed during the period of time under consideration. Capital (buildings and machines) is often a fixed input, but any input can be considered fixed if a contract is involved: land being leased, plant and equipment, management services, or skilled labor are examples. A firm cannot obtain more fixed inputs in the short run (or the cost would be prohibitive), and it is committed to pay for all fixed inputs even if it shuts down and does not use them. A firm can use more or less of its variable inputs in the short run, and its variable costs increase or decrease accordingly. The longer the time period, the more inputs become variable. Even land and buildings are variable inputs if the time period is long enough.

69. The short run is defined as the time period in which at least one of the firm’s inputs is fixed. The long run is the period of time in which all inputs are variable, but the basic technology of production is constant. There are no fixed inputs and no fixed costs in the long run.

There is no specific period of time which corresponds to the short run or the long run. The short run period of time will be different in different industries. In some industries it may be only a week or two, in other industries it may be years. It depends on how long it takes to obtain more of the temporarily fixed inputs or to sell existing fixed inputs. Consider how long it would take for you to start publishing a newsletter, using your
own computer, and mailing or emailing it to your friends. On the other hand, consider how long it would take for you to start manufacturing automobiles.

Short-run decisions concern how best to use existing facilities (fixed inputs like plant and equipment). In the short run, firms must decide how much output to produce and, sometimes, what price to charge. Long-run decisions are planning decisions involving whether to produce output and how to produce it. In the long run, firms must decide whether to start a business, whether to expand or contract the scale of production facilities, whether to begin production of new products or expand production to new areas, whether to replace, modernize, or reorganize production methods, and whether to leave the industry.

70. A production function describes the technological relationship between inputs and outputs. It indicates how many physical units of inputs are required to produce a given amount of output. It summarizes the characteristics of existing technology at a given point in time.

71. Total product (total output) is the amount of output produced during a period of time (it is a flow) by all of the factors of production employed. Average product of an input is the total product (quantity of output) divided by the quantity of the input, holding constant the amounts of all other inputs. Marginal product of an input is the change in total product divided by the change in the quantity of the input, holding constant the amounts of all other inputs. You can think of marginal product as the addition to total product created by the last unit of the input added to the production process. Total product, average product, and marginal product are all related to each other and they each express the relationship between inputs and output known as the production function. If you know any one of the three relationships, you can determine the other two.

The firm’s short-run production function (total product, average product, and marginal product) will change if the length of the time period changes, if the quantities of fixed inputs change, or if the state of technology changes.

<table>
<thead>
<tr>
<th>Labor</th>
<th>TP</th>
<th>AP</th>
<th>MP</th>
</tr>
</thead>
<tbody>
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<tr>
<td>12</td>
<td>1140</td>
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</tr>
</tbody>
</table>
72. The law of diminishing marginal returns states that if equal successive amounts of a variable input are added to a given amount of a fixed input, eventually the marginal product of the variable input will decline. The assumptions which are the basis of this law are 1) at least one input is fixed (thus, diminishing returns ONLY applies in the short run), 2) technology is unchanging, and 3) it is possible to vary the proportions in which various inputs are combined to produce output. Diminishing returns occurs because each additional variable input has less and less of the other (fixed) inputs with which to work. Diminishing returns are illustrated by a downward-sloping marginal product curve (and, if input prices are constant, by an upward-sloping marginal cost curve).

Increasing marginal returns are common at low rates of output, due to specialization and the division of labor. They are illustrated by the upward slope of the marginal product curve at low rates of input use. If input prices are constant, increasing marginal returns are also illustrated by the downward slope of the marginal cost curve at low rates of output.

73. The marginal/average rule: Whenever the marginal is greater than the average, the average will be increasing (notice that it makes NO DIFFERENCE whether the marginal is increasing or decreasing, as long as it is above the average). Whenever the marginal is less than the average, the average must be decreasing.

A. Example: A random sample of ten iron bars cut by a certain machine is taken and the lengths of the ten bars are measured in centimeters.

<table>
<thead>
<tr>
<th>Length (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
</tr>
<tr>
<td>48</td>
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<tr>
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<tr>
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<tr>
<td>56</td>
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<tr>
<td>57</td>
</tr>
<tr>
<td>58</td>
</tr>
<tr>
<td>60</td>
</tr>
</tbody>
</table>

The average length is 53 cm. An eleventh bar (the marginal, or last, bar) is 75 cm. long. The marginal is greater than the average (75 > 53), so the average increases to 55 cm. THE AVERAGE INCREASES WHEN THE MARGINAL IS GREATER THAN THE AVERAGE.

Suppose instead that the eleventh bar measures 42 cm. in length. The marginal is less than the average (42 < 53), and the average decreases to 52 cm. THE AVERAGE DECREASES WHEN THE MARGINAL IS LESS THAN THE AVERAGE.

B. Example: Your exam scores (out of 100) are 75, 75, and 75. Your average score is 75. On your fourth exam (the marginal exam) you earn 35 (out of 100). Your marginal is less than your average, so your average decreases to 65. On your fifth exam (the marginal exam) you earn 40 (out of 100). While your marginal is increasing (from 35 to 40), your marginal is still less than your average (40 < 65) and your average decreases to 60.

If your first three scores are 50, 50, and 50 (average is 50) and you earn 90 on your fourth (marginal) exam, your average increases to 60 because the marginal is greater than the average. Then on your fifth (marginal) exam you receive a score of 85. Your fifth score is less than your fourth score (the marginal is decreasing) but because your fifth score is still greater than your average (85 > 60) your average increases to 65. The marginal/average rule says nothing about whether the marginal is increasing or decreasing. All that matters is whether the marginal is greater than or less than the average.

Look at the graph of marginal product and average product for question #71. Whenever marginal product is greater than average product, average product is increasing as the quantity of labor is increased. This is true whether the marginal is increasing or decreasing. Whenever marginal product is less than average product, average product is decreasing as the quantity of labor is increased. Marginal product always intersects the average product curve where the average product is at a maximum.

74. Short-run cost functions (or curves) show how various types of costs are related to output. Costs are determined by 1) the physical returns summarized by the product functions (the technological relationship between inputs and output) and by 2) input prices.

Average costs describe production costs PER UNIT OF OUTPUT. Average costs signal when to shut down, when to produce at a loss, and whether economic profit will be negative, zero, or positive.

TFC = the firm’s total expenditure per time period on fixed inputs. As long as input prices are constant, TFC is constant regardless of the level of output. Graphically, TFC is a horizontal line.

TVC = the firm’s total expenditure per time period on variable inputs. Since higher rates of output require greater use of variable inputs, TVC always increases as output increases. Graphically, TVC starts at the origin and always slopes upward. Its typical shape is a backwards S.
TC = the firm’s total expenditure per time period on all inputs, both fixed and variable. Graphically, TC starts partway up the vertical axis (at the point where TFC intersects the vertical axis, since TC = TFC when output is zero) and always slopes upward. It has the same typical backwards-S shape as the TVC curve.

AFC = fixed costs per unit of output. Graphically, AFC always declines as output increases, but it never touches either axis.

AVC = variable costs per unit of output. Graphically, AVC tends to first decrease, then increase as output increases.

ATC = total cost per unit of output. Graphically, ATC tends to first decrease, then increase as output increases. ATC reaches its minimum at a higher rate of output than that associated with minimum AVC.

MC = the increase in total cost resulting from producing one more unit of output (or the decrease in total cost resulting from reducing output by one unit). MC is the cost of producing one more unit of output, or the cost of producing the last unit of output. All marginal costs are variable costs, since fixed costs do not vary with output. Graphically, MC is the slope of the TC (or TVC) curve. MC tends to first decrease, then increase as output increases. MC reaches its minimum at a lower rate of output than that associated with minimum AVC or minimum ATC.

Some useful formulas demonstrating the relationships between cost functions (or cost curves):

\[
\begin{align*}
TFC &= TC - TVC \\
TVC &= TC - TFC \\
TC &= TFC + TVC \\
AFC &= TFC/Q \\
AVC &= TVC/Q \\
ATC &= TC/Q \\
MC &= (\text{change in } TC)/(\text{change in } Q)
\end{align*}
\]

At low rates of output, there are often increasing marginal returns. MP is increasing and (as long as input prices are constant) MC is decreasing. TVC is increasing at a decreasing rate (increasing less and less for each unit of output).

When diminishing returns begin, MP is decreasing and (as long as input prices are constant) MC is increasing. TVC is increasing at an increasing rate (increasing more and more for each unit of output).

Average cost is the production cost per unit of output. Marginal cost is the cost of producing the last unit of output. When MC < AC (the cost of producing an additional unit is less than the average cost of producing all previous units), AC is declining. At higher rates of output, when MC > AC, AC is rising. This relationship exists for MC and ATC and it also exists for MC and AVC. Thus, the MC curve will always intersect the ATC and AVC curves at their minimum points.

<table>
<thead>
<tr>
<th>LABOR INPUT</th>
<th>TOTAL PRODUCT</th>
<th>AVERAGE PRODUCT</th>
<th>MARGINAL PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
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<td>100</td>
</tr>
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<tr>
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<td>203</td>
<td>5</td>
</tr>
</tbody>
</table>
The first four workers demonstrate increasing marginal returns (MP is increasing). Diminishing returns (declining MP) start with the fifth worker. For the first six workers, marginal product is greater than average product and average product is increasing. Marginal product equals average product where average product is at its peak (between 6 and 7 workers). Starting with the eighth worker, marginal product is less than average product and average product is decreasing. Negative marginal product means that hiring an additional worker causes the firm’s output to DECREASE. Since inputs cost money, no profit-maximizing firm would hire the twelfth or thirteenth workers in this example.

### Table 76

<table>
<thead>
<tr>
<th>LABOR INPUT</th>
<th>TOTAL PRODUCT</th>
<th>AVERAGE PRODUCT</th>
<th>MARGINAL PRODUCT</th>
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<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Diminishing returns start with the sixth worker. Marginal product equals average product at the peak of the average product curve (between six and seven workers).

### Table 77

<table>
<thead>
<tr>
<th>LABOR INPUT</th>
<th>TOTAL PRODUCT</th>
<th>AVERAGE PRODUCT</th>
<th>MARGINAL PRODUCT</th>
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78. (from #75)

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*Marginal cost is undefined here because output is not increasing as labor input increases.
Minimum MC is between 3 and 4 workers (Q between 540 and 860).
Minimum AVC is between 6 and 7 workers (Q between 1440 and 1680).
Minimum ATC is at 11 workers (Q = 2035).

(from #76)

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Minimum MC is at 4 workers (Q = 100).
Minimum AVC is between 6 and 7 workers (Q between 174 and 203).
Minimum ATC is at more than 10 workers (Q = more than 240).

(from #77)

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Minimum MC is between 1 and 2 workers (Q between 4 and 12).
Minimum AVC is between 2 and 3 workers (Q between 12 and 18).
Minimum ATC is at 5 workers (Q = 25).

Notice in all three examples that when MC is less than AVC, AVC is decreasing. When MC is greater than 
AVC, AVC is increasing. When MC is less than ATC, ATC is decreasing. When MC is greater than ATC, 
ATC is increasing.

Notice two ways of calculating ATC: TC/Q or AFC + AVC.
MC always reaches its minimum first, then AVC, and finally ATC.

79. The higher the average product of a given amount of a variable input, the lower will be the average 
cost of the output produced. If average product is higher, more output can be produced using the same 
amounts of variable inputs. More output at the same total cost leads to lower ATC, since \( ATC = \frac{TC}{Q} \). If input prices 
are constant, average product and average variable cost are inversely related.
Similarly, the higher the marginal product of a given amount of a variable input, the lower the marginal cost of the output produced. Marginal product and marginal cost are inversely related.

Changes in the quantities of fixed inputs, state of technology, or length of the time period may change the production function, or the cost curves. Cost curves are also influenced by input prices.

80. A firm minimizes the cost of producing at a given rate of output by combining inputs so that the marginal product PER DOLLAR is the same for every input used. Firms will pay twice as much for one input, if it is twice as productive. If the last dollar spent on each input increases a firm’s output by an equal amount, the firm is minimizing the cost of producing that quantity of output.

Suppose the last worker increased output by 50 and the last machine increased output by 100. Workers cost $10 per day and machines rent for $50 per day.

\[
\begin{align*}
\text{MPw} & = \frac{50}{10} > \frac{100}{50} = \text{MPm} \\
\text{Pw} & = 10 & \text{Pm} & = 50
\end{align*}
\]

While the last machine is twice as productive as the last worker, the machine costs five times as much! The last dollar spent on workers increased output by 5, but the last dollar spent on machines increased output by only 2. This firm should hire more workers and fewer machines. Due to diminishing returns, as the firm hires more workers their marginal product will decline. Due to diminishing returns, as the firm hires fewer machines their marginal product will increase. Eventually the firm will meet the cost-minimizing equation, with a more labor-intensive production process.

If the price of Input A increases, the firm will have an incentive to use less of Input A and more of other inputs. Input prices reflect their scarcity and opportunity cost (value in best alternative use). Firms seeking their own private profit (self-interest) will be led to use large amounts of the inputs which are plentiful (and inexpensive) and to economize on the use of very scarce resources (because they cost so much). The price system is an automatic control mechanism.

81. Long-run total cost is the total cost of all inputs when inputs are used in proportions designed to minimize cost at each rate of output. All costs are variable in the long run, so LRTVC = LRTC. There are no fixed inputs and no fixed costs in the long run.

Graphically, the long-run total cost curve begins at the origin. In the long run, if you produce no output you hire no inputs and total cost is zero. The long-run total cost curve always slopes upward, and often has a backwards-S shape (due to returns to scale, not due to diminishing returns).

82. Long-run average cost is the minimum average cost of producing at each rate of output, when all inputs can be varied. Graphically, if you draw all possible short-run average total cost curves, the long-run average cost curve shows the lowest average cost for each rate of output.

The shape of the LRAC curve depends on returns to scale (see #83 for more details). A downward-sloping LRAC (LRAC decreases as output increases) means there are economies of scale (increasing returns to scale). A horizontal LRAC (LRAC is constant as output changes) means constant returns to scale. An upward-sloping LRAC means there are decreasing returns to scale.

The shape of the LRAC curve influences how many firms may fit in an industry. Economies of scale (increasing returns to scale) can create a barrier to entry and exit, one of the most important determinants of market structure.

83. “Returns to scale” describe the long-run relationship between inputs and output in an industry. When inputs are all increased or decreased by the same proportion, what happens to output?

A. Increasing returns to scale exist if output changes by a larger proportion than the change in all inputs. If the firm doubles all inputs, it gets more than double the output. If the firm decreases all inputs by 25%, output decreases by more than 25%. Increasing returns to scale can be caused by greater long-run specialization and division of labor, more efficient production techniques which are too costly for smaller-scale operations, and certain geometric relations (often involving surface area vs. volume).

With increasing returns to scale, long-run average cost will be decreasing as output increases.

Suppose the firm doubles all inputs and gets triple the output. Total cost of inputs has doubled and output has tripled so average cost ( = TC/Q) is only 2/3 of its previous value.

B. Decreasing returns to scale exist if output changes by a smaller proportion than the change in all inputs. If the firm doubles all inputs, it gets less than double the output. If the firm decreases all inputs by 25%, output decreases by less than 25%. Decreasing returns to scale can be caused by difficulties in conveying information promptly and accurately as a firm grows (bureaucracy and red tape) and by difficulties in coordinating activities and decisions in a larger organization.
With decreasing returns to scale, long-run average cost will be increasing as output increases.
Suppose the firm triples all inputs and gets double the output. Total cost of inputs has tripled and output has doubled so average cost will have increased 50% (it is 1½ times its previous value).

C. Constant returns to scale exist if output changes by the same proportion as the change in all inputs. If the firm doubles all inputs, it gets double the output. If the firm decreases all inputs by 25%, output decreases by 25%.

With constant returns to scale, long-run average cost is unchanging as output increases (it is horizontal).

84. No, no, and no.
Minimum short-run average total cost may maximize the profit per unit of output (it does in perfect competition), but it does not maximize overall profit. A firm could earn $10 profit on each of 100 units of output ($1000 total profit) or $9 profit on each of 120 units of output ($1080 total profit).

Perfectly competitive firms may end up at minimum long-run average cost, after a long period adjustment to market forces. Where there are increasing returns to scale, firms do have an incentive to grow as long as their sales continue to increase. However, firms do not necessarily maximize profit by producing at minimum long-run average cost unless it is a perfectly competitive industry in long-run equilibrium.

Unit elastic demand means total revenue is maximized. Profit, however, depends on both revenue and costs. Suppose total revenue is maximized at $1200, and total cost is $1500 at that rate of output. It is more profitable to produce where total revenue is only $1000 and total cost is $900.

Part VI. Market Structure and Firm Behavior; Profit Maximization Rules

85. Market structure influences the numbers of buyers and sellers in the market, the similarity of products produced and sold, the equilibrium price of the product, the trade volume (equilibrium quantity of the product), the allocation of resources (how products are produced), the incentives for technological innovation, the behavior of buyers and sellers in the market (price wars? collusion? advertising? boycotts?), whether cost reductions are passed on to consumers, the ease of entry into the industry, and the likelihood of long-run economic profit.

As always, models are simplifications of reality. The four models help us understand many of the topics listed above, even though they do not include all real-world details.

86. A competitive market structure is one in which no individual buyer or seller has control over the market. None can significantly influence market price or quantity. The most competitive market structure is perfect competition. The least competitive market structure is monopoly.

Competitive behavior occurs when the actions of one decision maker influence the market conditions faced by other participants in the market. The most competitive behavior is most common in the least competitive market structures. (However, you don’t find a lot of competitive behavior in monopoly, since the monopolist faces no direct competition.) Oligopolists behave very competitively. Anything one firm does may affect the sales, revenue, and profit of the other firms in the industry. Perfect competitors have no reason to behave competitively. The actions of perfectly competitive firms have no effect on other firms in the industry.

87. An industry is made up of firms selling similar products. In the real world, it may not always be easy to determine whether various producers are all part of the same industry. Does the shoe industry include all shoes? Are women’s shoes, men’s shoes, and children’s shoes three different industries? What about boots, sandals, and slippers? Researchers and government often look at cross elasticity of demand to determine whether two products are part of the same industry. If they are close substitutes in consumption (positive cross elasticity), they are considered part of the same industry. This is important in antitrust actions against monopolists.

An industry supply curve is the sum of the supply curves of all the individual firms in an industry. At each price, add the quantities supplied by each firm.

88. The main characteristics of market structure are the number of sellers, the number of buyers, the similarity of products produced and sold by different firms in the industry, the strength of barriers to entry and exit, the importance of advertising and how advertising is used, and the likelihood of long-run economic profit.
89. The firm must decide whether to shut down or continue producing. If it decides not to shut down, it must then determine how much to produce. In some market structures, the firm must also determine what price to charge.

In the short-run, the firm has fixed inputs and fixed costs which must be paid whether or not the firm produces output. The short-run profit of a firm which shuts down is not zero. Profit is total revenue minus total cost. A firm which shuts down will have no revenue, but it still must pay its fixed costs. Short-run shutdown profit is equal to negative total fixed cost. Profit-maximizing firms may continue to produce at a loss in the short run if they would lose even more by shutting down. The shut-down decision is based on a comparison of total revenue and total variable cost. If the firm generates enough revenue to cover all of its variable costs, with enough left over to pay part of fixed costs, it should continue production.

The second decision is how much output to produce. If marginal cost exceeds marginal revenue, the last unit of output produced added more to cost than it did to revenue and the firm should produce less. If marginal cost is less than marginal revenue, the firm should increase production.

**Three rules of short-run profit maximization:**

1) Shut down if total revenue is less than total variable cost.
   Shut down if average revenue (price) is less than average variable cost.

2) If the firm does not shut down, it should produce where marginal revenue equals marginal cost.

3) Marginal cost must be increasing. This rule is a reminder for students, but is really not necessary to state. If marginal cost is decreasing, rule #1 is violated. If a firm finds a rate of output where marginal revenue equals marginal cost but marginal cost is decreasing, it has found the profit-MINIMIZING (or loss maximizing) rate of output!

In perfect competition marginal revenue is always equal to price. In perfect competition Rule #2 becomes, “Produce where price equals marginal cost.” This special case does not apply in market structures with downward-sloping demand curves (where price is greater than marginal revenue).

90. In the long run, all inputs are variable and firms must minimize the cost of producing at each rate of output. Firms maximize long-run profit by combining inputs so that the marginal product PER DOLLAR is the same for every input used. See question #80 above for details.

\[
\frac{MP_x}{P_x} = \frac{MP_y}{P_y} = \frac{MP_z}{P_z}
\]

for all inputs x, y, and z

**Part VII. Perfect Competition**

91. Perfect competition is a market structure with many small firms producing identical products. There are so many small firms that no individual firm has any control over the market. There is NO product differentiation. The barriers to entry and exit are minimal. With freedom of entry and exit long-run economic profit will be zero. Advertising is not necessary in this market structure, since firms can sell as much as they wish at the market price. Sometimes groups of producers will advertise, to increase the overall demand for their product (examples are milk producers, beef producers, and orange growers).

While individual buyers and sellers have no influence over market price, the actions of ALL buyers and ALL sellers taken together (market demand and market supply) determine the market price for the product. Each firm must take that price as given. If a perfect competitor raises its price even slightly, its sales will decrease to zero since buyers can get the same product from other producers at the market price. Perfect
competitors do not have to lower price to increase sales. Within their relevant ranges of production, firms can produce and sell as much or as little as they like without influencing the market price.

Thus, perfectly competitive firms face a perfectly elastic (horizontal) demand curve, equal to market price. Average revenue (TR/Q) is also equal to market price. Marginal revenue is the additional revenue from selling one more unit of output, which is also equal to market price in perfect competition (NOT in other market structures!). The demand curve facing an individual firm, the average revenue curve, and the marginal revenue curve are all the same horizontal line at market price.

Since perfectly competitive firms need not lower price to sell more output, the total revenue curve is a straight line starting at the origin (if the firm sells no output, its total revenue will be zero) and sloping upwards. Higher product price rotates the total revenue curve so it is steeper, and lower product price rotates it to it is less steep.

At the price of $0.30, this firm minimizes its economic loss by shutting down. Economic profit will be -$420 per time period.

At the price of $0.35, this firm minimizes its economic loss by producing 430 units of output per time period. Economic profit will be -$419.50 per time period (slightly less than the shut-down profit of -$420).

At the price of $0.50, this firm minimizes its economic loss by producing between 550 and 650 units of output per time period. Economic profit will be -$345 per time period.

At the price of $1.00, this firm maximizes its economic profit by producing between 720 and 770 units of output per time period. Economic profit will be zero.

At the price of $1.67, this firm maximizes its economic profit by producing 800 units of output per time period (using 8 workers, not 10!). Economic profit will be $516 per time period.

Note also that the firm will never hire the tenth worker, as it would reduce total product and increase total cost.
A. Minimum AVC is $0.3488, at 430 units of output per time period. Minimum ATC is $1.00 between 720 and 770 units of output per time period. AVC reaches its minimum at a lower rate of output than minimum ATC.

B. When product price is less than minimum AVC, the firm should shut down. If the price of the product is greater than minimum AVC ($0.3488), the firm should produce output even if economic profit is negative. The firm loses less by producing than it would by shutting down. If the price of the product were exactly equal to minimum AVC, the firm would lose an equal amount by producing or shutting down.

C. When product price is less than minimum ATC, the firm will earn negative economic profit (economic loss). When the price of the product is equal to minimum ATC ($1.00), economic profit will be zero. When the price of the product is greater than minimum ATC, economic profit will be positive.

D. If a perfectly competitive firm decides to produce output rather than shut down, it should produce where price equals marginal cost. At the price of $0.35, the firm should produce 430 units of output per time period, where marginal cost is $0.35 (between $0.2778 and $0.4167). At the price of $0.50, the firm should produce between 550 and 650 units of output per time period, where marginal cost is $0.50. At the price of $1.00, the firm should produce between 720 and 770 units of output per time period, where marginal cost is $1.00. At the price of $1.67, the firm should produce 800 units of output per time period, where marginal cost is $1.67.

93. The supply curve of a perfectly competitive firm is its marginal cost curve, ABOVE AVERAGE VARIABLE COST. Supply curves show the quantities supplied per time period at various prices, ceteris paribus. If price is less than minimum average variable cost, the firm will shut down and produce no output. At prices above minimum average variable cost, a perfectly competitive firm will produce at the rate of output where price (equal to marginal revenue in perfect competition) equals marginal cost.

The industry supply curve for perfect competition is the sum of all the individual firms’ supply curves – the sum of the individual marginal cost curves, above average variable cost.

94. In short-run equilibrium, perfectly competitive firms are maximizing economic profit by producing where marginal revenue (price) equals marginal cost. If price is less than minimum average variable cost, the firm will be shut down, producing no output. Three profit situations are possible: positive, zero, or negative economic profit.

95. In long-run equilibrium, perfectly competitive firms will still be maximizing economic profit by producing where marginal revenue (price) equals marginal cost. Due to freedom of entry and exit (minimal barriers to entry), long-run economic profit in a perfectly competitive industry is always zero. Positive short-run economic profit attracts new suppliers (industry supply increases, forcing price down and reducing profit) and negative short-run economic profit causes some firms to leave the industry (forcing price up and reducing losses). Thus, in the long run, perfectly competitive firms will be producing where price, marginal revenue, marginal cost, and average total cost are all equal. Perfectly competitive firms in long-run equilibrium produce at minimum average total cost. Note that they did not “decide” to produce at minimum average total cost because it is desirable. Market forces push perfect competitors to produce at that rate of output. Finally, perfectly competitive firms in long-run equilibrium produce at minimum long-run average cost (LRAC). If market price exceeds minimum LRAC, firms can earn positive economic profit by changing plant size, attracting more resources to the industry, and price is eventually forced to the bottom of the LRAC curve.

96. A. Short run: Higher income causes the market demand for normal goods to increase. The shortage created at the existing price causes price to increase. Individual firms increase their output (moving upward to the right along their marginal cost curves) and economic profit becomes positive.

Long run: Positive economic profit attracts new suppliers to the industry (and existing suppliers may expand), causing market supply to increase. The surplus created at the existing price causes price to decrease. Individual firms reduce their output (moving downward to the left along their marginal cost curves) and economic profit decreases. Firms continue to enter the industry until economic profits are zero, and firms are producing at the rate of output where average total cost is minimized.

B. Short run: When the price of a complement in consumption increases, the market demand for the good we are considering decreases. The surplus created at the existing price causes price to decrease. Individual
firms reduce their output (moving downward to the left along their marginal cost curves) and economic profit becomes negative.

**Long run:** Negative economic profit causes some suppliers to leave the industry, causing market supply to decrease. The shortage created at the existing price causes price to increase. Individual firms increase their output (moving upward to the right along their marginal cost curves) and economic profit goes from negative to zero. Firms will continue to leave the industry until economic profits are zero, and firms are producing at the rate of output where average total cost is minimized.

C. **Short run:** When input prices decrease, firms’ cost curves shift downwards and economic profit becomes positive. What happens to price and quantity in the short run depends on exactly how the cost curves shift.

**Long run:** Positive economic profit attracts new suppliers to the industry (and existing suppliers may expand), causing market supply to increase. The surplus created at the existing price causes price to decrease. Individual firms reduce their output (moving downward to the left along their new marginal cost curves) and economic profit decreases. Firms continue to enter the industry until economic profits are zero, and firms are producing at the rate of output where their new average total cost is minimized. The benefits of lower production costs are passed on to consumers in the long run.

D. **Short run:** When input prices increase, firms’ cost curves shift upwards and economic profit becomes negative. What happens to price and quantity in the short run depends on exactly how the cost curves shift.

**Long run:** Negative economic profit causes some suppliers to leave the industry, causing market supply to decrease. The shortage created at the existing price causes price to increase. Individual firms increase their output (moving upward to the right along their marginal cost curves) and economic profit goes from negative to zero. Firms will continue to leave the industry until economic profits are zero, and firms are producing at the rate of output where average total cost is minimized.

From these examples, we see that the price system in a free market acts as a signaling device and automatically allocates resources in accordance with society’s desires.

97. Many agricultural products are produced and sold in perfectly competitive markets (although if there are government subsidies, price supports, or other programs it would not be considered a free market). However, if products are labeled with brand names, or differentiated in any way, the market is not considered perfectly competitive.

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**Part VIII. Monopoly**

99. Monopoly is a market structure with only a single producer/seller, due to extremely strong barriers to entry and exit. There are no close substitutes in consumption for the monopolist’s product. Advertising is usually not necessary in monopoly. Sometimes monopolists do advertise, but the ads are usually designed to improve public relations or to inform buyers about alternative services, not to increase demand for or use of the product. Because of the strong barriers to entry, long-run economic profit may be positive or zero.

The monopolist faces a downward-sloping demand curve (the industry demand curve, since the firm is the industry). Marginal revenue is less than price for the monopolist, because of the downward-sloping demand curve. If the monopolist raises price it loses some, but not all, of its customers. In order to sell more output, the monopolist must lower price.

A monopolist is limited by the market demand curve. A monopolist cannot arbitrarily choose a high price and a large quantity and expect to sell that much. The monopolist can choose any price/quantity combination on the market demand curve. In a sense, the monopolist has absolute control over either price OR quantity, but not both at the same time. The monopolist can set price, and let the market determine the quantity sold. Or the monopolist can decide what quantity to sell and let the market determine the price.

Besides being limited by the market demand curve, monopolists face indirect and potential competition. While there are no close substitutes in consumption for the monopolist’s product, there are substitutes for almost everything. Phone calls, letters, email, instant messages are all substitutes. Cars, buses, taxis, and bicycles are all substitutes. Gas heating, wood stoves, home insulation and sweaters are all substitutes.

The greater the economic profit made by a monopolist, the stronger the incentive to create a substitute in consumption if none exists. Potential competition is the threat of another firm overcoming the barriers to entry and gaining a foothold in the monopolist’s market.
Monopoly power is really a matter of degree. Even monopolistic competitors have a limited amount of monopoly control over a market. If they raise their price, they will lose some, but not all of their customers. The more differentiated the product, and the less elastic the demand curve, the greater the monopoly power in the market.

100. Barriers to entry and exit protect the sheltered position of the monopolist. Some of the most common barriers to entry are patents (which grant exclusive rights to make or sell a certain product or use a certain production process), other types of government licensing and government franchises, control over essential resources, and economies of scale or other cost advantages.

Patents are designed to encourage research, development, innovation, and invention, by giving the inventor exclusive rights for a limited time. (In the U.S., utility patents last 20 years plus an extra year of “patent pending” status, while design patents last 14 years). Without patent protection, the results of research would become available to the general public very quickly. Patents allow inventors a limited time in which they may earn positive economic profit, to repay them for the time and other resources used in their research and development. If research did not lead to positive economic profit, little research would be carried out. Licensing can also be used, so that all producers use the new technology while paying the inventor fees.

Some firms maintain monopoly status by government franchise. Local telephone companies usually have exclusive licenses from states to provide local service. Some state governments grant electric companies the sole right to supply power in certain areas. Some states permit liquor to be sold only through state-controlled and state-managed liquor stores, giving government control over the industry. Governments that grant exclusive franchises usually reserve the right to regulate the monopolized industry.

If production requires a specific resource and one firm owns the entire supply of that input, the firm can have a monopoly on the product by refusing to sell the resource to other firms. The Aluminum Company of America (Alcoa) once owned or controlled nearly the entire world’s supply of bauxite, an ore required to produce aluminum. In 1945, Alcoa’s monopoly position was disrupted by antitrust action. The DeBeers Company of South Africa controls about 80% of the world’s supply of uncut diamonds. Their practices are so predatory and so limiting of market competition that they are not allowed to operate in the U.S.

“Natural monopolies” arise due to economies of scale (increasing returns to scale) in relation to the size of the market. If the long-run average cost of producing a product reaches its minimum at a rate of output large enough to satisfy the entire market demand, there may only be room in the industry for one producer of the most efficient size. Industries with a high proportion of fixed costs (like public utilities) are most likely to be natural monopolies. It would clearly be wasteful to duplicate the entire network of pipes, power poles, and cables throughout a city just to offer consumers a choice between service from two otherwise identical companies. The smaller the market, the more likely an industry is to be a natural monopoly. One of the disadvantages of tariffs is that they help to create separate little markets that can more easily be monopolized. One of the advantages of the European Union is that it creates a larger market that can support more competitive industries and more efficient production.

101. For a perfect competitor, every time one more unit of output is sold the firm receives the price of the product as revenue. Since perfect competitors do not have to lower price to sell more output, marginal revenue equals price. Monopolists, who face the downward-sloping market demand curve, must lower price to sell more output. If there is no price discrimination (products sold to different buyers at different prices, where the price differentials do not reflect cost differences), the monopolist must reduce price on ALL units to sell one more unit.

Imagine a monopolist selling 10 units of output per time period for $5.00 each. Total revenue is (10 x 5) = $50.00. To sell an 11th unit, the firm must reduce price to $4.75. Selling 11 units at $4.75 each, total revenue is (11 x 4.75) = $52.25. Marginal revenue (the change in total revenue from selling one more unit of output) for the 11th unit is ($52.25 - $50.00) = $2.25, even though its price is $4.75. While the firm receives $4.75 from selling the 11th unit, it loses $0.25 on each of the first 10 units (that could have been sold for $5.00, but were sold at $4.75 so that more output could be sold). $4.75 – (10 x $0.25) = $4.75 - $2.50 = $2.25.

102. In the absence of price discrimination, average revenue (total revenue divided by quantity of output) equals price and is found on the demand curve.

When demand is ELASTIC, raising price and selling less output will reduce total revenue. When demand is elastic, lowering price and selling more output will increase total revenue. Thus, when demand is elastic, marginal revenue is positive (reducing price and selling one more unit of output will increase total revenue).
When demand is INELASTIC, raising price and selling less output will increase total revenue. When demand is inelastic, lowering price and selling more output will reduce total revenue. Thus, when demand is inelastic, marginal revenue is negative (reducing price and selling one more unit of output will decrease total revenue).

When demand is UNIT ELASTIC, total revenue is maximized and small changes in price have no effect on total revenue. Thus, when demand is unit elastic, marginal revenue is zero (reducing price and selling one more unit of output will not change total revenue).

ELASTIC demand: Total revenue is inversely related to price and directly related to quantity. Marginal revenue is positive.

INELASTIC demand: Total revenue is directly related to price and inversely related to quantity. Marginal revenue is negative.

UNIT ELASTIC demand: Total revenue is unaffected by small changes in price and quantity. Marginal revenue is zero.

103. The graph of a monopoly has a downward-sloping demand curve (which shows price and average revenue) and a marginal revenue curve below the demand curve. For the average revenue curve (demand curve) to be decreasing as output increases, the marginal revenue curve must lie below the average revenue curve (remember the marginal-average rule). The profit-maximizing output occurs where marginal revenue crosses marginal cost. Follow that quantity up to the demand curve to find the profit-maximizing price.

104. A profit-maximizing monopolist will always operate in the ELASTIC region of its demand curve (the market demand curve).
   1. ANY firm maximizes profit by producing where MR = MC (as long as total revenue is greater than or equal to total variable cost).
   2. Marginal cost is always positive. Increasing output always causes total cost to increase. It is never cheaper to produce 10 units of output than it is to produce 9.
   3. Therefore, to maximize profit, a monopolist must produce where marginal revenue is positive (if it is to equal marginal cost, which is always positive).
   4. Marginal revenue is positive ONLY in the elastic region of the monopolist's demand curve.

If a monopolist is producing in the inelastic region of its demand curve, its marginal revenue is negative. By reducing output this monopolist could not only reduce total cost but could also increase total revenue. It could not have been maximizing its profit.

105. In the short run, monopolists may earn positive, zero, or negative economic profit. Monopolists are not guaranteed positive economic profit! If you have a monopoly on a product that no one wants, you are not likely to earn positive profit. In the long run, monopolists may earn zero or positive economic profit since the barriers to entry prevent new firms from entering the industry. A monopolist earning negative economic profit in the short run is likely to leave the industry in the long run unless subsidized by government. Many mass-transit systems are unprofitable but government subsidies keep them in business because we (as a society) have decided we want to encourage use of mass transit.

106. There is no unique relationship between market price and the quantity supplied by a monopolist. Monopolists' supply curves are always dependent on the demand curve for the product. At a particular price, the quantity supplied depends on the demand and marginal revenue curves. Similarly, a particular quantity may be supplied at any of a number of prices, depending on demand. The supply curve of a monopolist is NOT its marginal cost curve. For a monopolist, price does not equal marginal cost at the rate of output being supplied.

107. The only similarity between monopoly and perfect competition is that advertising is not a necessary part of either business. Monopoly is a single seller of a product with no close substitutes, in an industry with the strongest barriers to entry. Perfect competition involves many small sellers of identical products (perfect substitutes), in an industry with minimal barriers to entry and exit. A monopolist faces the downward-sloping market demand curve for the product. The demand curve facing a perfectly competitive firm is perfectly elastic (horizontal). For a monopolist, demand and average revenue and price are all greater than marginal revenue. For a perfect competitor, demand and average revenue and price and marginal revenue are all equal. A monopolist maximizes profit by producing where marginal revenue equals marginal cost, and price is greater than both. A perfect competitor maximizes profit by producing where marginal revenue, marginal cost, and price are all equal. Monopolists may earn positive economic profit even in the long run. Long-run
profit for perfect competitors is always zero, due to freedom of entry and exit. Monopolists tend to produce less and charge a higher price than perfect competitors would. In the long run, perfect competitors produce the product in the most efficient way (producing at minimum long-run average cost).

Part IX. Monopolistic Competition

108. Monopolistic competition, like perfect competition, involves many small sellers. Unlike perfect competition, monopolistic competitors produce differentiated products. Product differentiation leads to a downward-sloping demand curve facing monopolistic competitors, unlike the perfectly elastic (horizontal) demand curves facing perfectly competitive firms. Although the demand curve is downward-sloping, it is likely to be highly elastic, due to the large number of close (but not identical) substitutes. Like perfect competition, monopolistic competition has minimal barriers to entry and exit. This leads to zero long-run economic profit, as in perfect competition. Unlike perfect competition, advertising is an important part of most monopolistically competitive industries.

Monopolistic competition is not similar to monopoly. There are many small sellers (not one monopolist), the products have many close substitutes (monopolists’ products have no close substitutes), there is freedom of entry and exit (monopolists have the strongest barriers to entry and exit), and advertising is very important (it is not required for monopolists). The main similarity between monopolistic competition and monopoly is the downward-sloping demand curve. This leads to a marginal revenue curve below the demand curve (price exceeds marginal revenue, as it does in monopoly). Graphically, monopolistic competition resembles monopoly because of the downward-sloping demand curve (though it is usually very elastic in monopolistic competition due to the number of close substitutes available).

Monopolistic competition is a competitive market structure with a very small degree of monopoly power. If a monopolistic competitor raises its price it will lose some, but not all, of its customers.

109. The graph of a monopolistic competitor has a downward-sloping demand curve (usually very elastic due to the large number of close substitutes available) and a marginal revenue curve below the demand curve. The demand curve is the same as the average revenue curve. The total revenue curve is similar to that of a monopolist, due to the downward-sloping demand curve. The profit-maximizing output occurs where marginal revenue crosses marginal cost. Follow that quantity up to the demand curve to find the profit-maximizing price.

110. Product differentiation is any difference perceived by buyers. It doesn’t matter whether the differences between products are real or imagined. For products to be differentiated, it is only necessary for buyers to regard the products as different. There may be differences in quality, style, features, brand names, store location, availability of parking, friendliness of salespeople, and many other factors.

111. In short-run equilibrium, monopolistically competitive firms are maximizing economic profit by producing where marginal revenue equals marginal cost. Price will be greater than marginal revenue and marginal cost. If the average variable cost curve is completely above the demand curve facing the firm, the firm will shut down and produce no output. Three profit situations are possible: positive, zero, or negative economic profit.

112. In long-run equilibrium, monopolistically competitive firms will still be maximizing economic profit by producing where marginal revenue equals marginal cost. Due to freedom of entry and exit (minimal barriers to entry), long-run economic profit in a monopolistically competitive industry is always zero. Positive short-run economic profit attracts new suppliers (giving existing firms a smaller share of overall market demand, shifting the demand curve downward and to the left, and reducing profit) and negative short-run economic profit causes some firms to leave the industry (giving existing firms a larger share of overall market demand, shifting the demand curve upward and to the right, and reducing losses). In the long run, monopolistic competitors will operate where price equals average total cost, but this will not be at the lowest point on the average total cost curve. For profit to be zero (and positive profit to be impossible) the demand curve and the average total cost curve must be tangent (touch at only one point). Since the demand curve is not horizontal, this point of tangency will not occur at minimum average total cost.

113. Monopolistic competitors with exactly the same cost curves as perfect competitors will tend to produce less and charge a higher price. Monopolistic competitors’ cost curves are likely to be higher than those of perfect competitors, however, due to advertising expenses. Perfect competitors operate at minimum short-
run average cost and at minimum long-run average cost. Monopolistic competitors produce at a lower rate of output than minimum average cost, and thus do not minimize short-run or long-run average cost. Monopolistic competitors are also likely to construct plants smaller than the minimum-cost (most efficient) size of plant that would result in perfect competition. Price equals marginal cost for profit-maximizing perfect competitors, but price exceeds marginal cost for profit-maximizing monopolistic competitors. Monopolistic competitors offer a wide variety of styles, brands, and qualities than perfect competitors (who sell a standardized, uniform product). Monopolistic competitors spend more on advertising and other selling expenses (non-price competition). Whether the additional variety and freedom of choice is worth the inefficiency and additional expense is a normative question.

114. Retailing in the U.S. is monopolistically competitive. Each retailer has a small degree of monopoly power because of location, product lines, and salespeople, but the extent of this power is limited because there are many other firms selling reasonably similar substitute products. Entry into the retail trade is relatively easy, requiring little money or skill (compared to many other industries). Firms enter and leave the industry constantly. There are more firms in retailing than would exist if each were operating where average costs were minimized. Retailers spend a great deal on selling expenses, especially advertising. Economic profit in retailing is low, as the model predicts. Gas stations, restaurants, clothing stores, shoe stores, fast-food drive-throughs, and quick markets (like 7-11) are all examples of monopolistic competition.

Part X. Oligopoly

115. It is difficult to describe oligopoly because there are so many different types of oligopoly. Oligopoly is a broad category that covers many kinds of market structures and firm behaviors. There is not one economic model that fits all the different kinds of oligopoly. Oligopoly has “few” sellers. There could be two large sellers, half a dozen large sellers, or even several large sellers that dominate the market and a few hundred smaller sellers. The dominant firms in an oligopoly are large enough to influence price. The products of oligopolists are sometimes identical (copper, cement) and sometimes differentiated (automobiles, airlines). Strong barriers to entry exist in oligopoly, so long-run economic profit may be positive. Advertising is usually very important in oligopoly, but where products are homogeneous there may be little advertising.

The most unique characteristic of oligopoly is the INTERDEPENDENCE of firms. In monopoly, there is only one firm in the industry. In both perfect competition and monopolistic competition, each firm is so small that its actions have no effect on the sales/revenue/profit of other firms in the industry. The complex interdependence of firms makes oligopoly difficult to analyze, since the behavior of any one firm depends in part on the expected reactions of all other firms in the industry. Besides predicting how buyers will react to any change in price, quantity, quality, style, features, advertising, or non-price competition, oligopolists must anticipate how the other firms in the industry will respond. In oligopoly, price and output are not determined by considerations of marginal cost, marginal revenue, and demand alone. The real and imagined reactions of rivals must also be considered. Oligopoly is a non-competitive market structure in which we see the most intense rivalries (competitive behavior) between firms. (Refer back to #86 for the difference between competitive market structure and competitive behavior by firms.)

116. Strong barriers to entry and exit exist in oligopolies. Some of the same barriers to entry that cause monopoly may, in weaker form, create oligopolies. Patents with licensing (so other firms may pay for the privilege of using the patent), government franchises to several firms (like taxicabs), less-than-complete-control over an essential input, and economies of scale can cause the development of oligopolies. Economies of scale (increasing returns to scale) can create “natural oligopolies” if the most efficient plant size is so large that, given market demand, there is only enough room in the industry for a few firms.

Established firms may have other cost advantages (besides increasing returns to scale) such as knowledge from experience in production and sales or well-established credit that permits advantageous purchasing and borrowing. These cost advantages may be temporary, but by carefully watching for signs of attempted entry to the industry, established firms can keep price low enough (below newcomers’ minimum average total cost) to ensure that new firms will experience economic losses and will never get a foothold in the industry.

Existing firms can sometimes create barriers to entry. One example is brand proliferation, where firms sell many different brands of only slightly differentiated products. Increasing the number of brands sold may reduce the expected sales of a new entrant to the industry. The number of different types of breakfast cereals or cigarettes might lead you to think those industries are monopolistically competitive, but in fact they
are both oligopolies. Product differentiation and brand names can create substantial barriers to entry where technological barriers like economies of scale are weak.

Another example of a created barrier to entry is advertising. If existing firms spend millions on brand-name advertising, new firms will also have to advertise heavily to bring their products to the attention of buyers. If the firm’s sales are small (frequently the case for new entrants to an industry), the advertising cost per unit sold (average cost) will be high. Remember that industries with a high proportion of fixed costs are most likely to become natural monopolies. If existing firms advertise so much that new entrants are required to match advertising expenditures even though they produce and sell only a small amount of output, advertising becomes a sort of “fixed cost” that makes entry more difficult.

Since entry is so difficult in oligopoly, the primary competition often comes from established oligopolies in other countries (where they already serve large markets and enjoy low average costs of production).

117. There is no single unified model of oligopoly behavior because one model cannot cover all the relevant types of oligopoly adequately. There are a number of models, each based on different assumptions about the number of firms, the similarity of products, the types of barriers to entry, the importance of advertising, and the history of relationships between firms. The interdependence of firms, found in no other market structure, is hard to quantify because so much uncertainty is involved.

In general, oligopolists are responsive to two sets of conflicting influences. Oligopolists would like to cooperate with rivals to maximize total industry profit, which then might be divided equitably among firms. However, each firm is primarily interested in its own individual profit and individual profit may be maximized only by acting in ways incompatible with industry-wide cooperation.

118. The kinked demand curve model is a simple model designed to explain the relative stability of oligopolistic prices despite large shifts in demand and/or production costs. The demand curve facing an oligopolist is kinked at the existing price and quantity. At higher prices, the demand curve is elastic because when an oligopolist raises its price its competitors will not raise their prices. Thus by raising price the oligopolist loses many customers. At lower prices, the demand curve is inelastic because when an oligopolist lowers its price its competitors will match the price reduction. Since they are all reducing their prices, there may be small increases in quantity demanded but firms will not be attracting customers away from their rivals. Oligopolists fear losses if price is changed in either direction, and are highly motivated to maintain the status quo. Because of the kink in the demand curve, the marginal revenue curve is discontinuous. The current price and quantity will be most profitable even if costs change considerably.

This is an incomplete model of oligopoly. It explains why price and quantity tend to be so stable, but does not explain how the existing price and quantity were determined. Also, there are other possible explanations for inflexible prices. It may be so costly to change prices (printing and distributing new price lists and advertising) that it is done very infrequently. If prices are determined by collusive agreements among all the firms in an oligopoly, it may be too costly and time consuming to renegotiate.

119. Some models emphasize the game-like characteristics of oligopoly. As in a game, each firm must take account of its rivals’ reactions to its own actions. An oligopolist cannot predict the effects of a change in its price, output, product, or advertising on its profits without guessing how its competitors will react to the change. In game theory, each firm has a choice of strategies and follows specific rational rules in decision making. There are many different versions of game theory, depending on the assumptions made about the rules the firms will follow.

120. Conditions in oligopoly tend to promote collusion, since the number of firms is small and they recognize their interdependence. There are many advantages to collusion: increased profit, decreased uncertainty, and better opportunity to prevent entry. In some countries, formal agreements among firms create legal cartels. In the United States, most collusive agreements are illegal (Sherman Antitrust Act of 1890).

A cartel must decide on a pricing policy (usually acting as a monopolist with a number of plants) and determine a way to allocate sales among the member firms. The sales allocation process is a bargaining process. Sometimes markets are divided geographically, or according to past history of sales, but firms with more influence and the shrewdest negotiators are likely to receive the largest sales quotas. Collusive agreements usually restrict output and raise price.

For many reasons, collusive agreements are difficult to achieve and maintain. In the U.S. they are illegal (which makes them more difficult to achieve and maintain, but does not eliminate them entirely!). The more firms there are in an oligopoly, the more difficult it is to reach unanimous agreement. The less similar the products, the harder it is to find a common price strategy acceptable to all firms. The greater the variation in
firms’ sizes and cost structures, the harder it is to reach agreement (low cost firms will be inclined to reduce price).

Most importantly, there is a constant temptation for oligopolists to cheat on any collusive agreement. If other firms follow the agreement by restricting output and raising price, a firm that cheats (by price-cutting and increasing output) can take business away from the other firms and earn large (if temporary) economic profit. The incentive to cheat on collusive agreements is especially high when an industry’s sales are down and profits are low.

Cartels require unanimous cooperation, and one firm refusing to cooperate can prevent an agreement from being formed or break up an existing agreement.

121. Non-price competition includes all forms of competition other than price cutting. Product differentiation, advertising, décor, salespeople, extended warranties, free delivery, parking and other amenities are all examples of non-price competition.

Price competition (trying to attract customers away from rivals by reducing the price of the product) is often very limited in a stable oligopoly. Price wars hurt all sellers in an industry. A firm’s rivals can easily and quickly match a price reduction, but they may be unable to match a clever advertising campaign or an innovative improvement in the product itself.