Chapter 2 Supply and Demand

Chapter Summary

This chapter covers all the basics of supply and demand analysis beginning with the definition of a market. The example of the market for lobsters in Hyannis, Massachusetts, on July 20, 2014, is used to make the discussion concrete. The chapter derives demand curves, and supply curves, and presents the concept of an equilibrium price.

The section entitled "Some Welfare Properties of Equilibrium" develops the idea that if price and quantity are not at the equilibrium values, resources could be allocated so as to make everyone better off (the term "Pareto optimality" is not presented, but the discussion follows this line of thought). Examples of denied airline boarding compensation and rent control are presented to bolster the argument.

The section entitled "Determinants of Supply and Demand" discusses the factors that shift demand curves and supply curves, and presents examples for each case. The following section discusses price supports in detail. The chapter concludes with the algebra of supply and demand.

The appendix introduces the effects of a lump sum tax on either side of the market concluding that the effects are the same whether the tax is put on the buyer or the seller.

Chapter Outline

Chapter Preview
Supply and Demand Curves
Equilibrium Quantity and Price
Adjustment to Equilibrium
Some Welfare Properties of Equilibrium
Free Market and the Poor
Determinants of Supply and Demand
The Algebra of Supply and Demand
Summary
Appendix: How Do Taxes Affect Equilibrium Prices and Quantity?

Learning Objectives

LO1: Explain how the demand and supply curves summarize the behavior of buyers and sellers.
LO2: Explain why the equilibrium in a market identifies a price-quantity pair for which buyers and sellers are satisfied.
LO3: Explain how shifts in supply and demand curves cause equilibrium prices and quantities to change.
LO4: Explain why transactions can always be found that make some parties better off without harming others whenever a market is not in equilibrium.
LO5: Explain why attempts to peg prices below or above their equilibrium levels produces negative side-effects and describe both the rationing and allocative functions of prices.
LO6: List some determinants of supply and demand.
LO7: Solve for equilibrium prices and quantities when supply and demand curves are expressed in algebraic form.

Teaching Suggestions

1. This chapter reviews and goes a bit beyond the supply and demand models that most students will have had in principles of microeconomics. It might be helpful to list the supply and demand curves in a slightly formal way. For example, list the demand curve as $Qx = f(Px, Py, I, N, T, E)$, where Qx is the amount of X consumed, Px is the price of X, Py is the price of an alternative good, I is income, N is the number of buyers, T is a lump sum sales tax, and E is expectations. (If the appendix is omitted you may want to drop the T from the equation.) Now ask the students to put + or - signs under each item in parentheses to show what relationship they think exists between that item and the quantity variable. The Px is an easy minus, but the Py will be both signs depending on whether the alternative good is a substitute or a complement. Income likewise has a + or - depending on whether a good is normal or inferior. In this manner the student is then prepared for the next step. Since a demand curve has only two axes, it can deal with only the Qx and Px. Thus movement along a demand curve will relate to changes in Px only. All the other variables are held constant. If one of them is changed while Px and all the others are held constant, then the curve shifts. In like manner, the supply variables can be dealt with. For example, $Qx = (Px, Pi, Te, T, E)$, where Pi is the price of inputs, Te is the level of technology, T is a lump sum producer tax, and E is again expectations.

2. Since this is the market model being developed, it might be a good time to have the students involved in a bit of a market activity. I like to invite students to come to the board to fill in the signs of the functions discussed above. It is more interesting to have them reason through the relationships, but very few are willing to stick their neck out in the first week of class. Here is where incentives come in. I offer 50 points on the next test to someone who will volunteer. If the answer is perfect, 50 points will be added to the test score. This usually results in a dozen volunteers or more, so I start to auction my way down to where only one student remains. Rarely do I need to give more than a few points away. This game accomplishes several things if it is used frequently in class. First, students come prepared if for no other reason than to bid down the point totals so they do not have their relative standing in class hurt. Second, it gets students involved explaining things, which is the way they learn best. Third, it teaches many lessons about market prices and how scarce resources can be allocated.

3. This is the time to use a supply and demand model to relate to consumer welfare, production cost, and consumer surplus. Use letters as shown below to illustrate how any output other than the equilibrium amount will result in lower net welfare generated by the market.
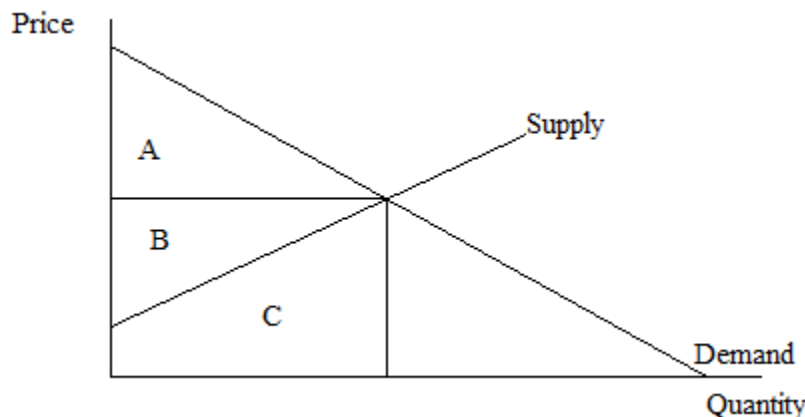
Stumbling Blocks for Students

1. The horizontal and vertical interpretations of demand should be presented simply as alternative ways of reading numbers from a graph. Later when horizontal summation of demand is used to obtain a market demand or when vertical summation of demand is used in public goods the terminology could get confusing.

2. Students with a good background in math will wonder why economists have quantity on the horizontal axis if they consider price to be the independent variable in the demand function. Since the usual procedure is to put the independent variable on the horizontal axis a brief comment on convention and the problems of change would be appropriate. Perhaps it would be good to give advance notice that in imperfect competition we have firms setting quantity and charging what the market will bear.

3. What does it mean for a market to be efficient? Market efficiency and the maximization of net welfare are not readily seen as the same thing by students. Efficiency has the idea of least cost, and until the perfect competition model is fully developed, students will not see average costs at their minimum when competitive markets are in equilibrium. This is a good place to emphasize that the goal of markets is to deliver welfare to consumers, not profits to producers. Thus efficiency means finding the largest area under the demand curve after costs are subtracted. It should be easy to see that this will occur at equilibrium.

4. (Appendix) For some reason it is much harder to see the effect of a sales tax on the demand curve than to see the effect of a lump sum producer tax on the supply curve. Therefore, it is helpful to illustrate vertically that the level the consumer is willing to pay is the original demand curve, but the amount of revenue the producer receives is less than the amount paid. Thus the demand curve experienced by the producer is the original demand minus the tax measured vertically. The case problem in the workbook should reinforce this idea and help get the notion across.

Answers to Review Questions

1. A shortage occurs when, at a given price, quantity demanded exceeds quantity supplied. Scarcity implies that not everyone can consume as much of a good as he wants. A good can be scarce without a shortage occurring if the price of the good is set at the market equilibrium.

2. The supply curve would be a horizontal line where the price equals zero. The demand curve would be a typical demand curve. If the price is greater than zero, then the market system is acting to allocate resources; not everyone can have as much as they want.

3. Some examples: Parking places for the president of the college; giving seniors priority in class assignments. Shortage of parking spaces and students being bumped from preregistration.

4. The former implies a shift in the supply curve; the latter a movement along the supply curve.

5. a. Change in demand
    b. Change in quantity demanded (shift in supply)
    c. Change in the quantity demanded (shift in supply)
    d. Change in demand

6. Because consumers prefer to pay a lower price.

7. The allocative function of price is not important with vertical, or nearly vertical, supply curves, e.g., land.

8. For the tax burden to fall mostly on consumers rather than producers (buyers rather than sellers), you want to find a product (or products) for which the quantity supplied is very responsive to price but quantity demanded is less responsive to price. Addictive goods like cigarettes and alcohol may fit this description.

9. If a poor person were given $50,000 in cash, it is unlikely he would spend it on a Mercedes, since he probably has other, more pressing wants. Since the gift Mercedes would fetch less than the cash gift, most poor persons would choose the cash.

Answers to Chapter 2 Problems

1. a) The imposition of the ceiling price on tea causes a reduction in the quantity of tea bought, from Q_1 to Q_2 (left panel). The result is a leftward shift in the demand for lemons, resulting in a reduction in both price and quantity (right panel).
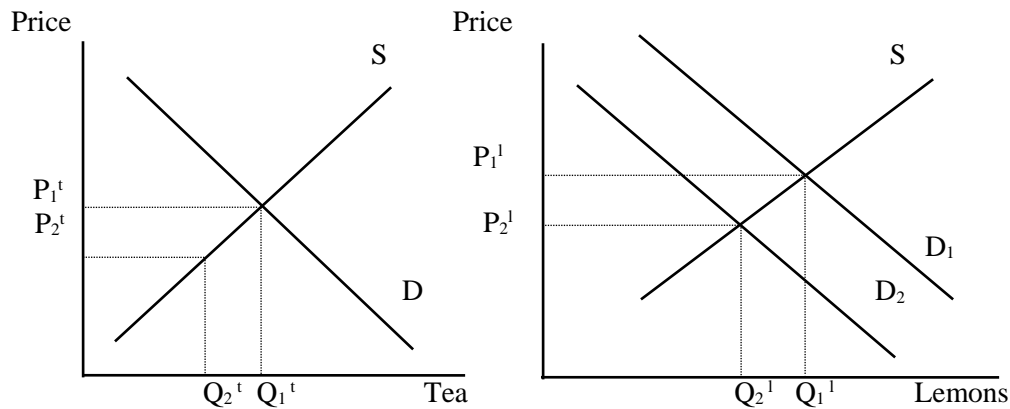

b) The ceiling price for tea lowers the quantity people are able to buy from Q_1^t to Q_2^t. There is excess demand for tea at the ceiling price P_2^t, and some of this excess demand spills over to substitute products such as coffee. The result is that the equilibrium price of coffee rises.

(Note: This result may seem inconsistent with the claim that a fall in the price of a good's substitute reduces the demand for that good. But this claim refers to a fall in the *equilibrium* price of the good, not a price reduction caused by a ceiling. Because of the quantity reduction caused by the ceiling, tea buyers would be willing to pay P_3^t for tea. So the price ceiling actually raises the opportunity cost of additional units of tea.)
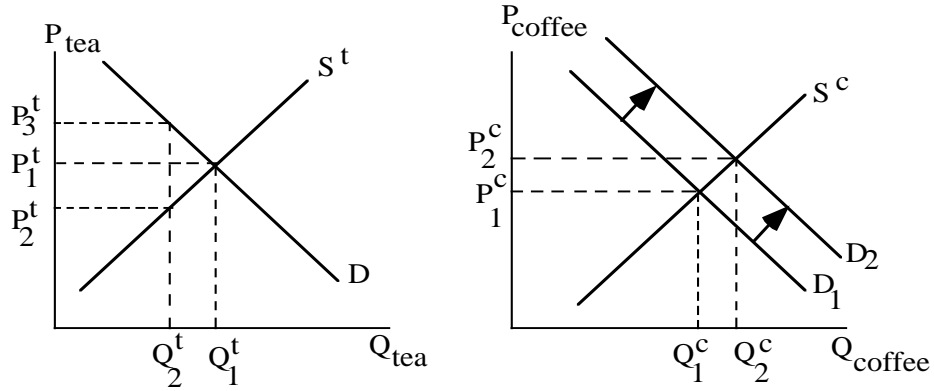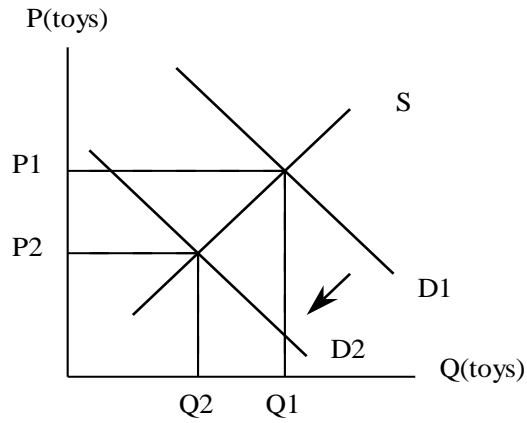
2. a) At prices of 35 and 14, there will be 7 DVDs traded in the market. At P=35, sellers are dissatisfied. At P=14, buyers are dissatisfied.

    b) The supply and demand curves, shown in the diagram, intersect at P=28, Q=14
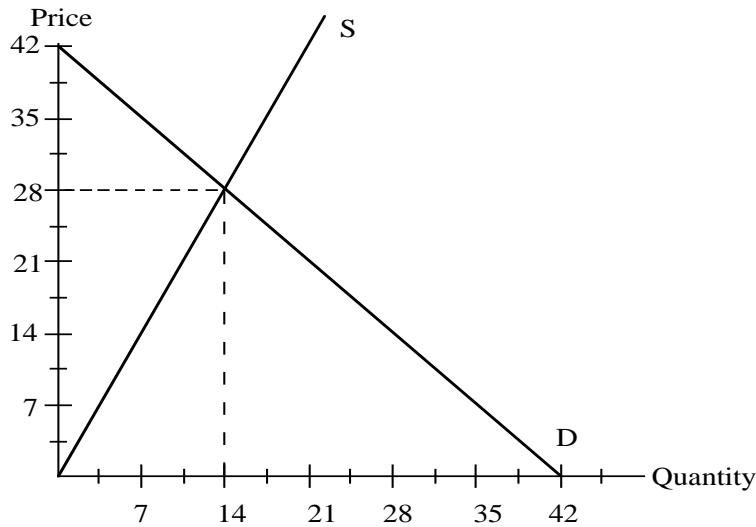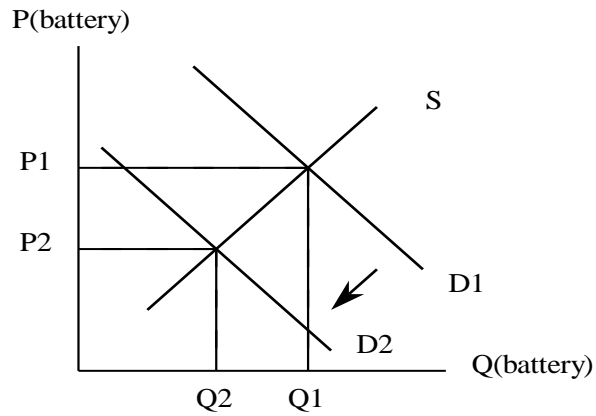

    c) Total revenue is (28)(14) = 392.

3. a-b) A reduction in the price of hardware would raise demand for software and thus cause equilibrium price and quantity of software to rise. On the other hand, a rise in the price of software would reduce demand for hardware and thus cause the equilibrium price and quantity of hardware to fall.
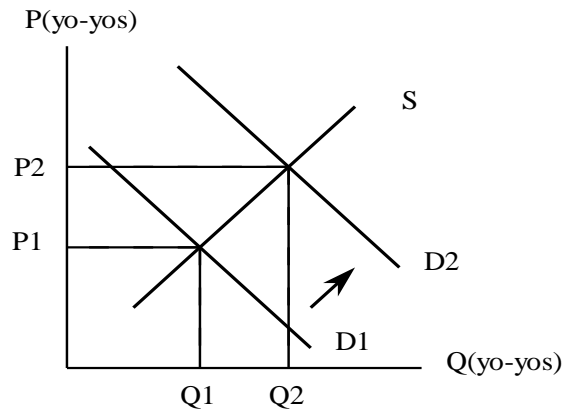
4. a) Both price and quantity drop.

P(toys)

P1

P2

S

D1

D2

Q(toys)

Q2   Q1

b) Both quantity and price drop.

P(battery)

P1

P2

S

D1

D2

Q(battery)

Q2   Q1

c) Both price and quantity go up.

P(yo-yos)

P2

P1

S

D2

D1

Q(yo-yos)

Q1   Q2

5. a) The price goes up, the quantity goes down.

P(oil)

S2

S1

P2

P1

D

Q(oil)

Q2   Q1

b) The price and the quantity go down.

P(air)

S

P1

P2

D1

D2

Q(air)

Q2   Q1
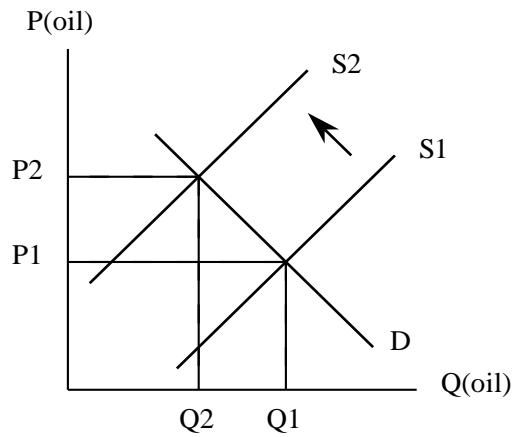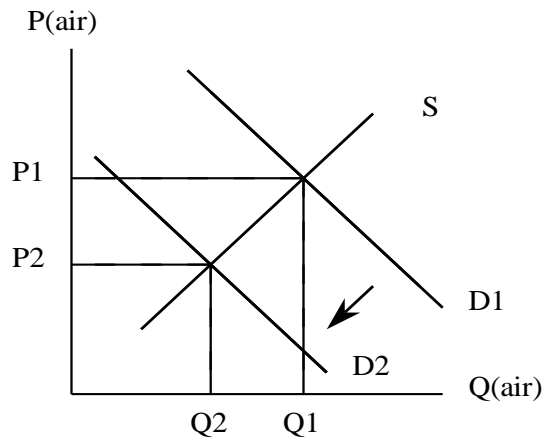
c) The price and the quantity go up.

P(rail)

S

P2

P1

D2

D1

Q(rail)

Q1   Q2
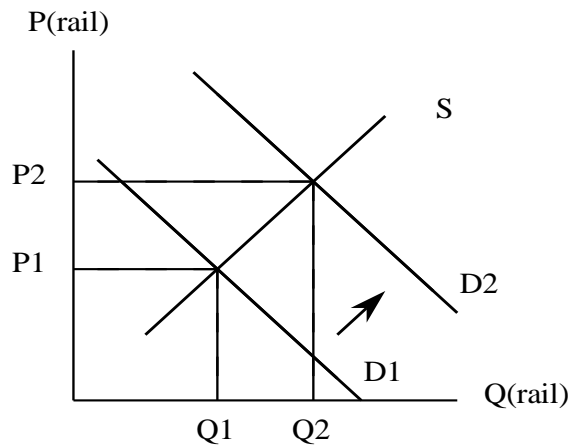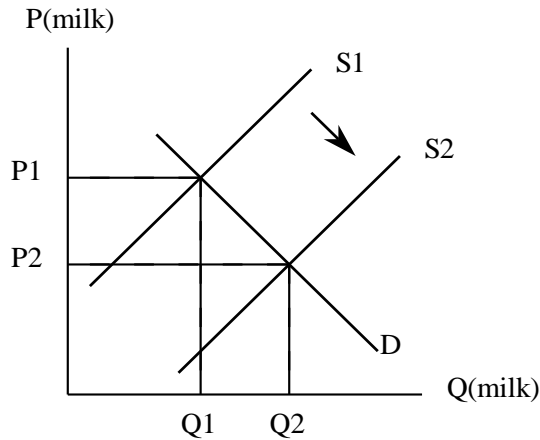
d) The price and the quantity go down.
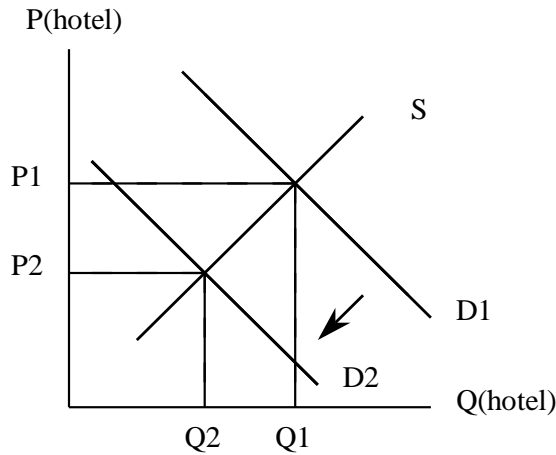
e) The price goes down, the quantity goes up.

6. a) Change in quantity demanded.
   b) Change in demand.
   c) Change in demand.
   d) Change in demand.
   e) Change in quantity demanded.

7. a) The equilibrium quantity is Q = 90,000 seats and the equilibrium price is P = 1900 – (1/50)(90,000) = 1900 – 1800 = $100.

   b) At a price ceiling of P = $50, quantity demanded is found by solving 50 = 1900 – (1/50)Q for Q = 92,500 seats. Since the stadium only holds Q = 90,000 seats, there will be 92,500 – 90,000 = 2,500 dissatisfied fans who want to buy a ticket at P = $50 but cannot find one available.

c) Quantity demanded for the higher demand is found by solving $50 = 2100 – (1/50)Q$ for $Q = 102,500$ seats. Now there will be $102,500 – 90,000 = 12,500$ dissatisfied fans who want to buy a ticket at $P = \$50$ but cannot find one available. The excess demand is $12,500 – 2,500 = 10,000$ seats more than for the not so big game.

d) Normally a price ceiling both raises quantity demanded and lowers quantity supplied. Here, only the first effect is present because the stadium capacity is fixed.

Problem 2-17
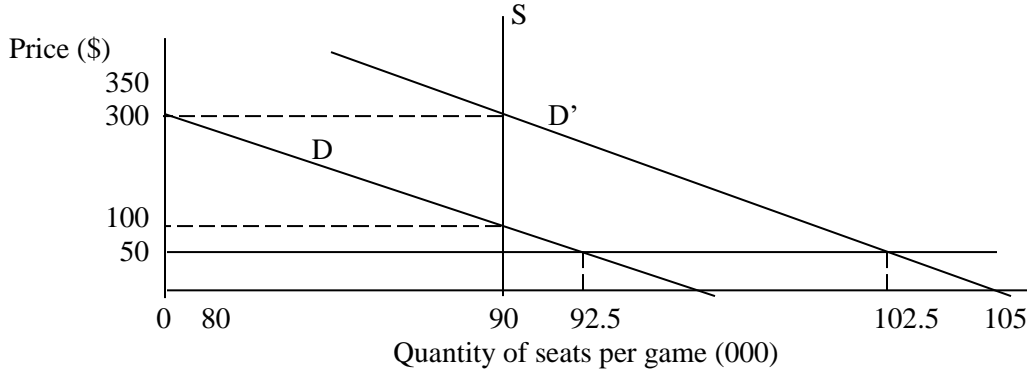
8. a) Under the original demand curve, quantity demanded was $Q = 900$ units and quantity supplied $Q = 300$ units, so excess demand was $900 – 300 = 600$ units. With the larger demand, quantity demanded becomes $Q = 1100$ units, so excess demand becomes $1100 – 300 = 800$ units. Excess demand has grown by $800 – 600 = 200$ units.

b) Quantity demanded is $Q = 1400 – P$; quantity supplied is $Q = P$. Subtracting quantity supplied form quantity demanded gives excess demand of $1400 – 2P$ units. Set excess demand equal to the original level of 600 and solve $600 = 1400 – 2P$ for the required price floor of $P = \$400$. If the government accommodates the increase in demand by raising the rent control form $300 to $400, the degree of excess demand will be unchanged.


9
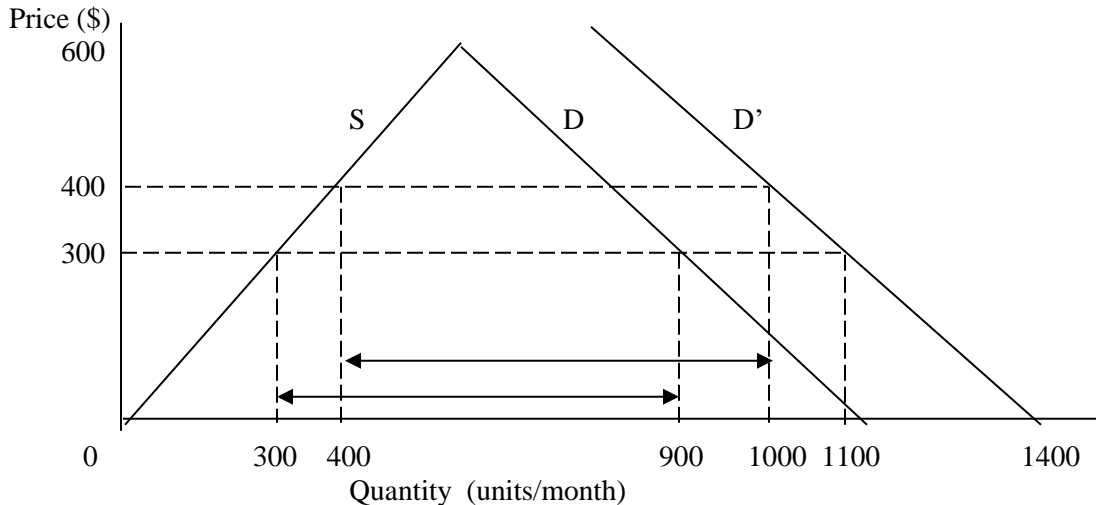
9. a) With a price support of P = $500/ton and the original supply of P = Q, quantity supplied
    must be Q = P = 500 tons. Meanwhile, quantity demanded is Q = 100 tons, so excess supply
    is 500 – 100 = 400 tons. With the expanded supply of P = (1/2)Q, quantity supplied grows to
    Q = 2P = 1000 tons. Quantity demanded is still Q = 100 tons, so excess supply grows to
    1000 – 100 = 900 tons.

    b) The extra 900 – 400 = 500 tons the government has to buy of excess supply costs the
    government $500/ton, so the added expenditure is 500(500) = $250,000.
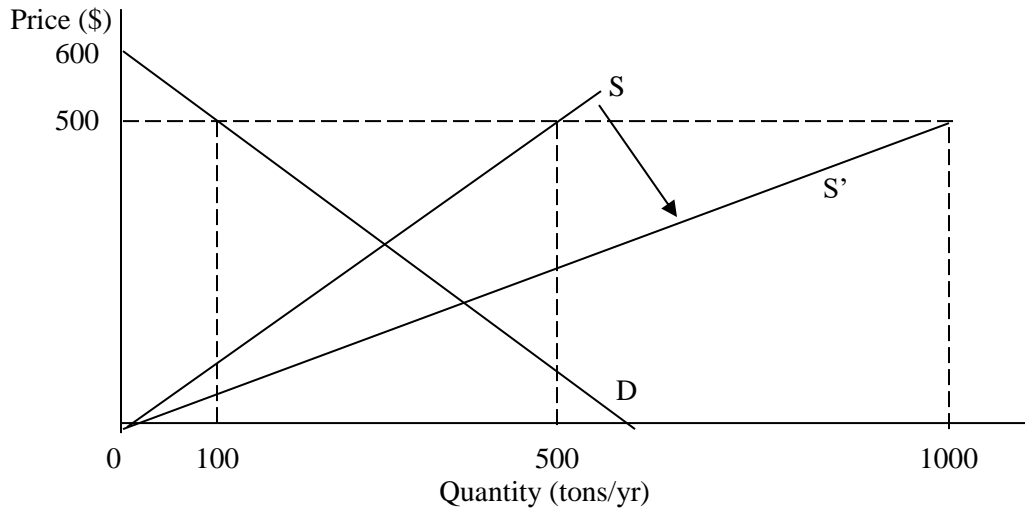
10. The supply curve becomes P = 2 + 2Q and the demand remains P = 8 – 2Q. By setting the
    two equations equal to each other and solving for Q we have Q = 1.5. Substituting 1.5 into
   the demand equation results in a price of 5.

Answers to Appendix Problems

1. The supply curve after the tax is shown as S' in the diagram. The new equilibrium quantity
    will fall to 2. The equilibrium price paid by the buyers is now $4/oz. The price received by
   the sellers is now $2/oz.

10
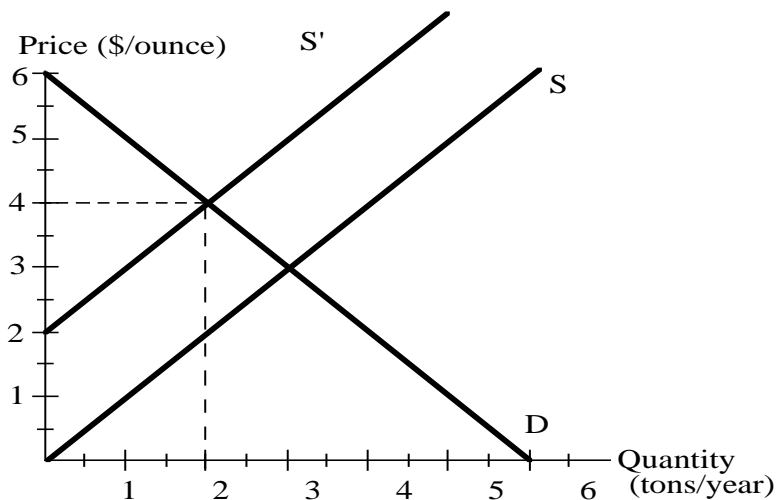
CHAPTER 2: Supply and Demand

2. The supply curve tells us that at a quantity of 2 tons/yr, suppliers will be willing to supply additional titanium at a price of $2/oz. At that same quantity, buyers are willing to pay $4/oz. Suppose a supplier sells one ounce to a new buyer at a price of $3. This will make the supplier better off by $1. The buyer will also be better off by $1.

3. With the tax of T = $2/oz on sellers, the supply curve shifts up by the amount of the tax from P = Q to P = 2 + Q. The intersection of the tax-ridden supply curve and the new demand curve is found by solving 8 – Q = 2 + Q for Q = 3 tons. Inserting the quantity into the demand curve yields a price buyers pay of P = 8 – 3 = 5 an ounce and hence a price sellers receive of P = 5 – 2 = 3 an ounce. The government collects revenue of TQ = 2(3) = $6. Prior to the increase in demand, the government collected the tax on only 2 ounces, so its total revenue collected was $4. Thus, government revenue has grown by 6 – 4 = $2 due to the expansion in demand for titanium. See the graph below

Price of Titanium ($)

Quantity of Titanium (tons/yr)
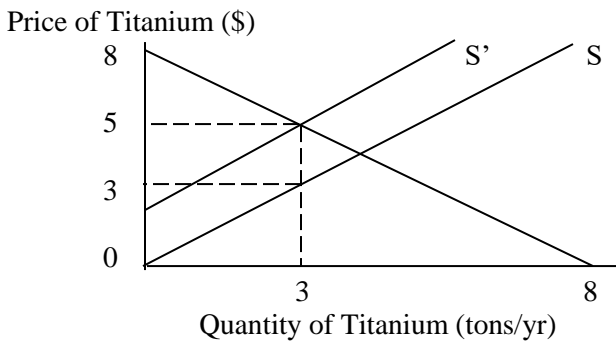
4. At a price floor of P = $4/oz, quantity supplied would be Q = 2 tons. Using demand P = 6 – Q and P = $4/oz, quantity demanded is also Q = 2 tons. Thus, the reduction in supply raises the equilibrium price to the level of the price floor, so the price floor is no longer binding.

Price of Titanium ($)

Quantity of Titanium (tons/yr)
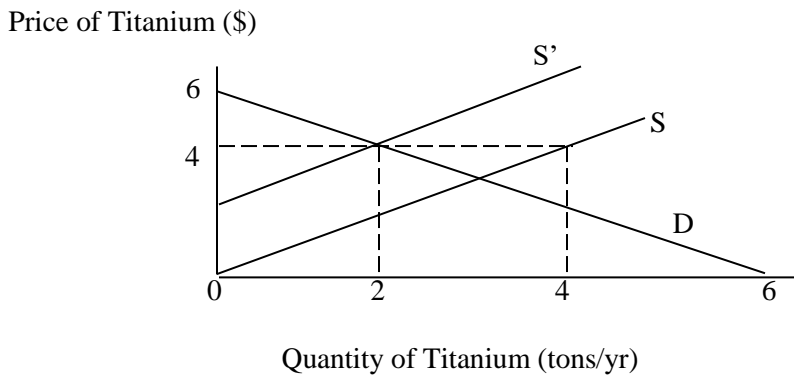
5. a) The effect of the tax is to shift the supply curve upwards by $9 as shown in the diagram on the next page. The quantity sold falls to 11 units.
b) The new market price is 31, of which the seller gets to keep only 22.
c) Buyers now spend 11(31) = 341.
d) The government collects 11(9) = 99.

11

e)
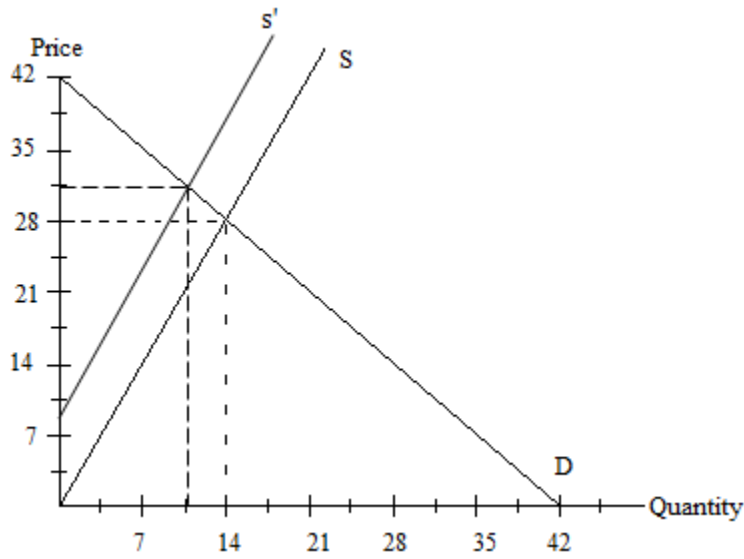
6. a-b) The seller's share is the fall in price received by the seller divided by the total tax: $t_S = 6/9 = 2/3$. The buyer's share is the increase in price divided by the total tax: $t_b = 3/9 = 1/3$.

7. In the diagram below, P* and Q* are the original equilibrium price and quantity of Japanese cars sold in the U. S. If a quota of Q_1 is imposed, Japanese car makers will be able to charge P_1 for their cars. To get the same quantity reduction by means of a tax, the after tax supply curve must intersect the demand curve at Q_1 . The result is a price to the U. S. buyer of P_1, the same as in the quota case. The difference in the two policies is that in the quota case the price increase goes to Japanese car makers, while in the tariff case it goes to the U. S. government.

12
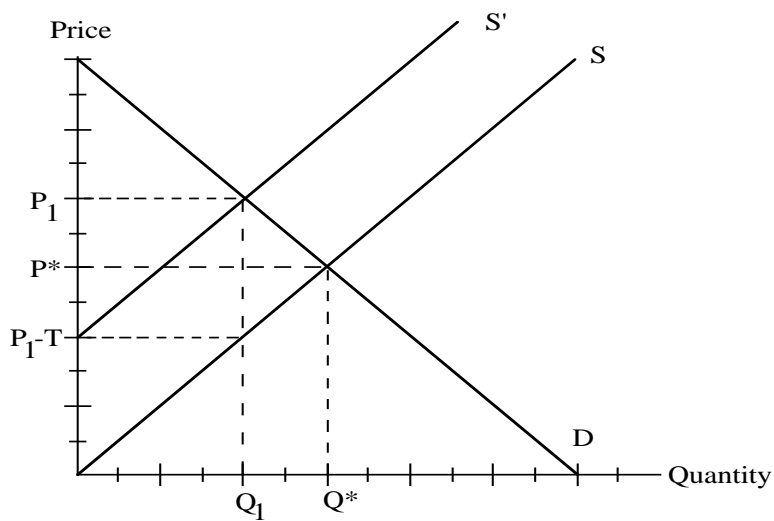
8.
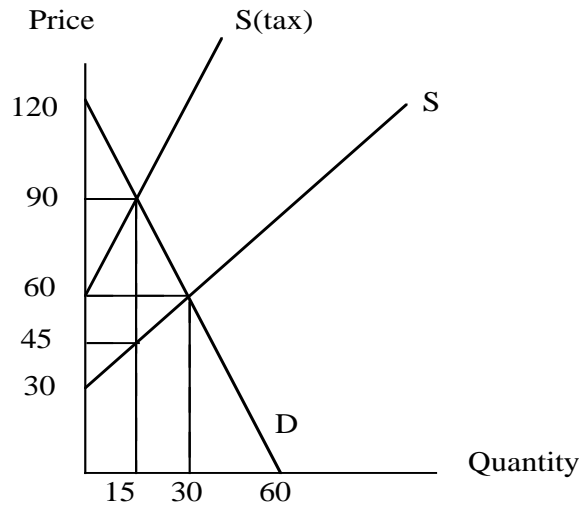
  a) Before tax: 120-2Q=30+Q (in equilibrium)   Q=30   P=60

  b) After tax supply curve: $P = 60 + 2Q$
     Equilibrium: $120 - 2Q = 60 + 2Q$
     $Q = 15$
     Price, including tax = 90
     Price received by seller (net of tax) = 45.

  c) Sellers share = $60 – 45 = 15$ Buyer's share = $90 – 60 = 30$

9. a-c) With the tax on sellers, supply rises by the amount of the tax to $P = 4 + 4Q$. the
    equilibrium is found by solving $20 = 4 + 4Q$ for $Q = 4$ units. Buyers pay $P = \$20$ and sellers
    receive $20 – 4 = \$16$. Sellers pay the full tax because demand is perfectly elastic, which
    means that buyers cannot be forced to pay any of the tax.
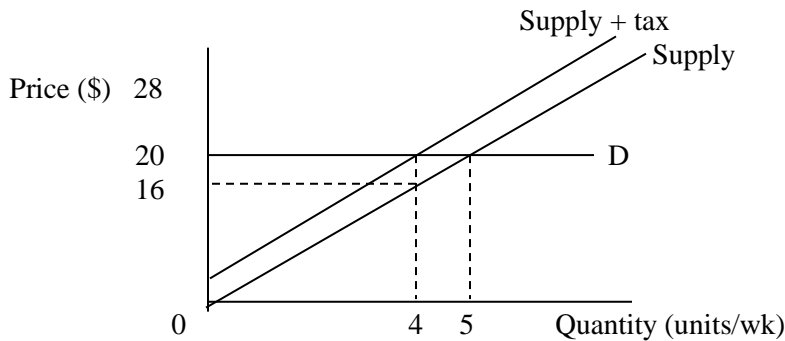
10. a-c) With the tax on buyers, demand falls by the amount of the tax to P = 24 – Q. The
equilibrium is found by solving 20 = 24 – Q for Q = 4 units. Sellers receive P= $20, and
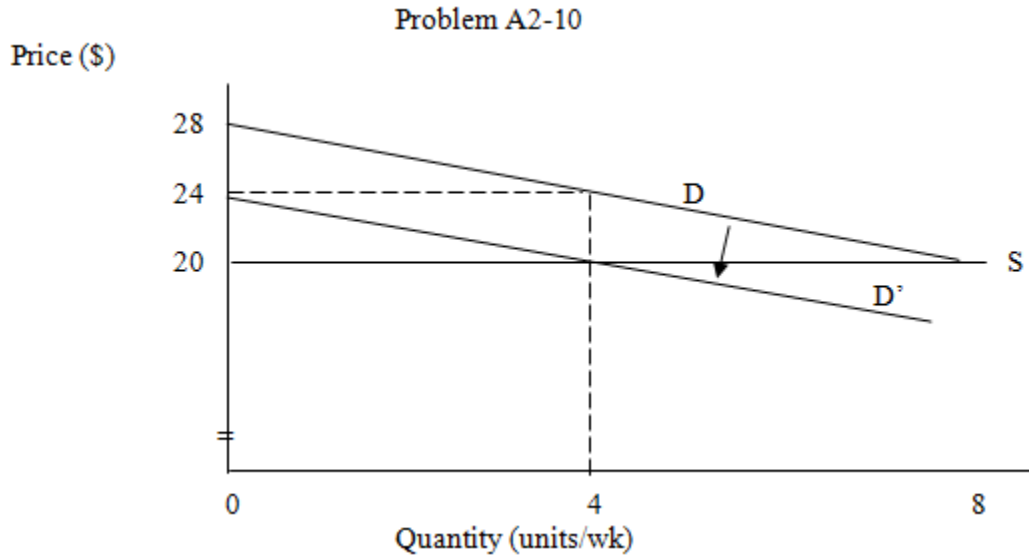buyers pay 20 + 4 = $24. Buyers pay the full tax because supply is perfectly elastic, which
means that sellers cannot be forced to pay any of the tax.

Problem A2-10

Price ($)

Additional Problems

1. For each of the following situations, what happens to the beer market? Indicate whether the
   demand curve or the supply curve shifts and, if so, in what direction. Indicate what happens
   to equilibrium price and quantity.
   a. The Surgeon General announces that consumption of alcohol has been linked to birth
      defects.
   b. The price of wine increases.
   c. The price of hops (an ingredient in beer production) increases.
   d. The drinking age is raised from 18 to 21.

2. The supply curve for T-shirts is given by the equation P = 6Q. The demand curve is given by
   the equation P = 18 - 3Q.
   a. What is the equilibrium price and quantity?
   b. At a price of $18, will there be a surplus or a shortage? Indicate by how much.
   c. At a price of $6, will there be a surplus or a shortage? Indicate by how much.

3. You've just been called in by Congress to give advice on the rice market facing American
   farmers. For each of the following events analyze what will be the effect on the equilibrium
   price and quantity facing U.S. farmers. Show whether the demand curve or the supply curve
   shifts.
   a. The Japanese eliminate restrictions on sales of U.S. rice.
   b. A new strain of wonder rice is developed which increases productivity.
   c. Rice is found to cause cancer in white mice.
   d. The price of wheat increases.
   e. The price of fertilizer used in rice production increases.

4. Explain in terms of supply and demand of life insurance why the price rises as people get older even though the demand for life insurance goes down as they get older and children become self sufficient.

5. In Washington DC the metra system is priced lower during rush hours when demand is high and the price rises when fewer people are riding during non rush hour times. Explain this strange pricing system using the market model.

6. The notion of demand did not become a part of accepted economic theory until the mid to late 19th century. Until then, value was viewed as objective and based largely on cost of production because the subjective nature of preferences and personal benefit seemed beyond practical analysis. Now it is customary to see demand as an important part of the value of things. List three specific cases where individual subjectivity is very apparent in determining value and where the production cost seems to be irrelevant.

7. There may be a few items where the demand curve is upward sloping. Explain how this can happen and give an example of this unusual case.

8. (Appendix) Many states are increasing the tax on gasoline. Show with supply and demand diagrams the effect on the equilibrium price and quantity.

Answers to Additional Problems

1. a) The demand curve shifts left. Equilibrium price and quantity fall.
   b) The demand curve shifts right. Equilibrium price and quantity increase.
   c) The supply curve shifts left. Equilibrium price rises and quantity falls.
   d) The demand curve shifts left. Equilibrium price and quantity fall.

2. a) Setting supply and demand equal: $6Q = 18 - 3Q$; $9Q = 18$; $Q = 2$;
   $P = 12$.
   b) At $18, for supply, $Q = P/6 = 3$. Demand: $Q = (18-P)/3 = 0$. There will be a surplus of 3.
   c) At $6, for supply, $Q = P/6 = 1$. Demand: $Q = (18-P)/3 = 4$. There will be a shortage of 3.

3. a) Demand shifts right; equilibrium price and quantity increase.
   b) Supply shifts left; equilibrium price falls, and equilibrium quantity increases.
   c) Demand shifts left; equilibrium price and quantity fall.
   d) Demand shifts right; equilibrium price and quantity increase.
   e) Supply shifts left; equilibrium price rises, and equilibrium quantity falls.

4. As people get older they need less life insurance so the demand should shift left reducing price. However, the probability of death increases with age so suppliers of life insurance are willing to offer it only at increased prices. Thus it is a leftward supply shift that more than offsets the leftward demand shift. In other words there is a change in demand and a change in the quantity demanded.

5. The purpose of the metra is to take pressure off traffic congestion in the streets. Therefore the metra pricing is designed to reduce demand for car traffic during rush hour. In off hours there is less need to entice travelers off the roads. This shows the interconnectedness of markets and how the pricing system in interdependent between markets.

6. Many examples could be used here. Perhaps speculation in financial markets, such as with bitcoin currency, would be the best example where speculative behavior determines price as demand moves up and down when speculative fever prevails. Things like property of famous people sell for very high prices due to their subjective value and the fact that they are in fixed supply so demand alone determines price fluctuations. The internet has given sellers information about online buyers and if a buyer show repeated interest in a given product its price may rise just for that buyer because the producer sees the strong desire for the item. Ticket scalpers at sold out events reap benefits from demand driven prices. The list could go on, but it is clear that subjective demand as well as objective cost is a driver of prices.

7. If the quantity demanded rises as the price rises the good or service is a prestige item that brings pleasure because others are impressed by the lavishness displayed. One example might be the clothing worn by celebrities at awards parties. High priced outfits that are designed by famous designers are in greater demand purely because they are known to be expensive. Another example would be at auctions of rare artwork. Some bidders may have had no interest until the bidding went very high and the announcement effect of a high priced purchase would bring acclaim. These rare examples are usually limited to the wealthy who seek the public limelight and can afford to pay for it.

8. (Appendix) If the tax is imposed on the consumers at the point of sale the demand curve will shift down buy the amount of the tax. If the sellers have to pay the tax the supply curve will shift up by the amount of the tax.
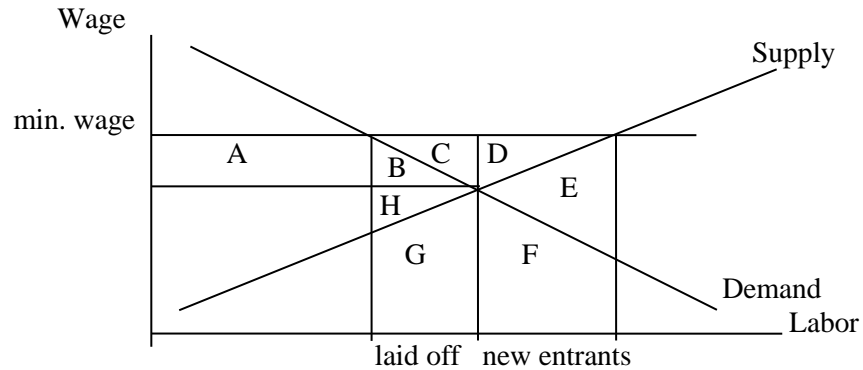
Answers to Homework Assignment

HOMEWORK ASSIGNMENT   **KEY:** _____Chapter 2_____

1. Use a labor market supply and demand model to answer the following questions.
   a) **From an equilibrium position a minimum wage is set above the going wage. Sketch graph this possibility and show 1) the amount of new entrants into the labor market, 2) the number of workers laid-off from their jobs.**

   b) **Is society better or worse off because of the new minimum wage law?**
Since both a yes or no could be correct here you must explain your reasoning, perhaps with graphic support. The workers who retain their jobs get (A) more income, but the workers laid off now have no income and those who are new in the labor market but not employed also are frustrated. The more elastic the demand and supply of labor, the worse the problem.

2. Find a newspaper clipping which relates to one point of the chapter outline shown in this chapter. Identify which outline point is involved and how the story relates to it.
Anything related to supply and demand would be relevant so virtually anything works if the explanation makes sense. This is a chance to help the grades a bit.

3. A public official once tried to calm public fears concerning a supply induced spike in gasoline prices by saying, "The high price will reduce demand and therefore price will soon fall again." What is wrong with this statement?
This statement confuses a change in quantity demanded with a change in demand. The reason prices rose was because supply shifted left which cause the quantity demanded to change to the new equilibrium price. The higher price will not shift demand left so that price can fall. Other factors that shift demand left could come into play or the supply could shift right again for some reason, but they are the only thing, short of price ceilings, that can lower the price of gasoline.

CHAPTER 2: Supply and demand

4. Two supply curves are as follows. P = 10 + Q and P = 10 + 50Q. If you were going to impose a price ceiling that was 20% below the market price, which supply condition would create the least excess demand? Why?

Because the slope of the supply curve is steeper in the second equation the supply is much less sensitive to price changes and so the quantity supplied of the commodity is reduced less due to the price change. Therefore the excess demand is less also.

5. NAFTA was designed to increase trade between countries in North America by cutting tariffs for goods flowing between countries. If the demand function for US computers in Mexico is P = 10 - Q, which supply curve would lead to the most increase in trade after the tariffs are eliminated on computers? 1) S = 1 + Q   2) S = 1 + .5Q   Show graphically why your answer is correct.
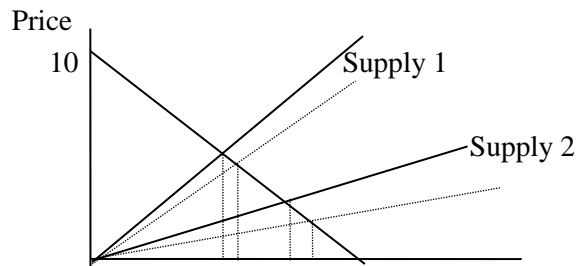
Supply 2 will be more sensitive to price changes from lower tariffs so trade will increase more under that supply curve. See the dotted supply lines effect on quantity.

5. Some say that many robberies are rational acts by criminals who calculate the expected costs and benefits of their actions. Using the supply and demand market model as a reference point, describe how you might reduce crimes.

Rational criminals will calculate the costs of their actions and so by increasing penalties or adding more police and surveillance equipment the probability of getting caught and the expected jail time goes up adding to the cost of crime. If the benefits of crime are viewed as a demand curve and the costs are a supply curve, then the supply shifts left, the price of crime rises and less crime occurs. The demand curve would be unaffected because the benefits of stealing would not necessarily fall.