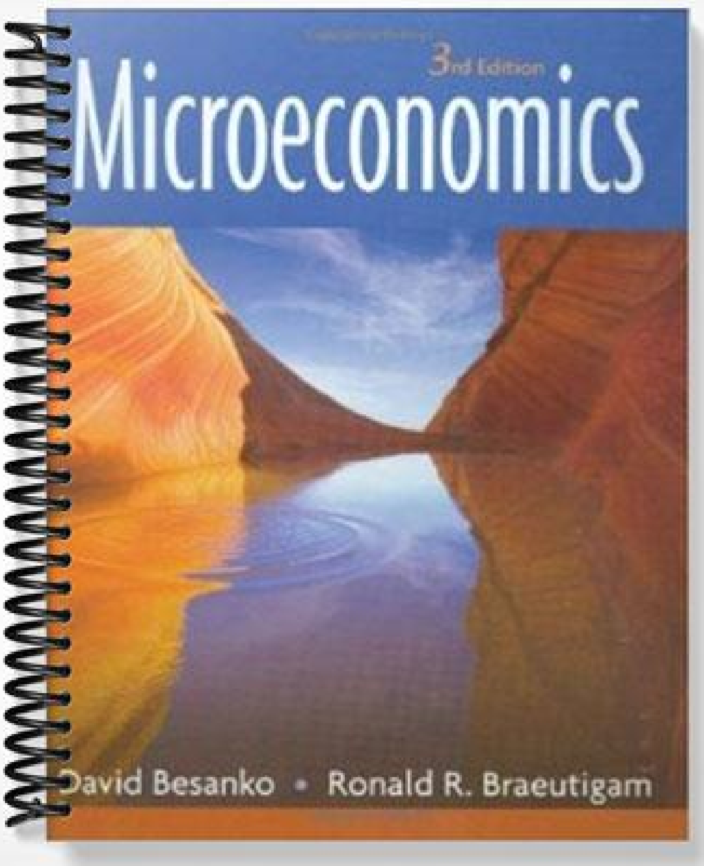
SOLUTIONS MANUAL



Chapter 2

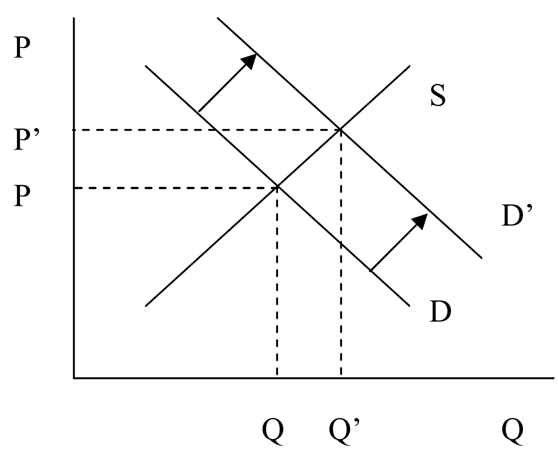
Supply and Demand Analysis

Solutions to Review Questions

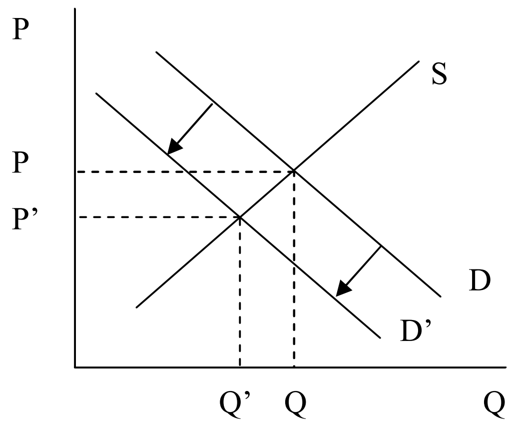
1. Excess demand occurs when price falls below the equilibrium price. In this situation, consumers are demanding a higher quantity than is being made available by suppliers. This creates pressure for the price to increase. As the price increases, quantity demanded will fall as quantity supplied increases returning the market to equilibrium.

   Excess supply occurs when price is above the equilibrium price. Suppliers have made available more units than consumers are willing to purchase at the high price. This creates pressure for the price to decrease. As the price decreases, the quantity demanded will go up while at the same time the quantity supplied will decrease, returning the market to equilibrium.

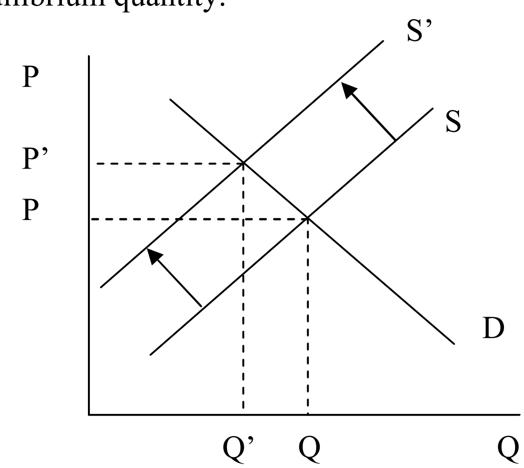
2. An increase in the price of a substitute, such as tea, will increase demand for coffee, raising the market equilibrium price and quantity.



a) This study will reduce demand for caffeine drinks, lowering the market equilibrium price and quantity.

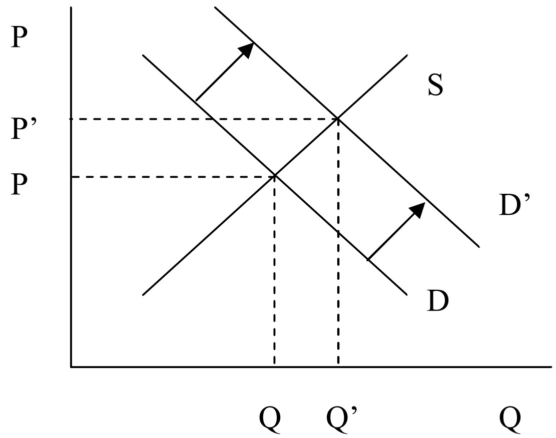


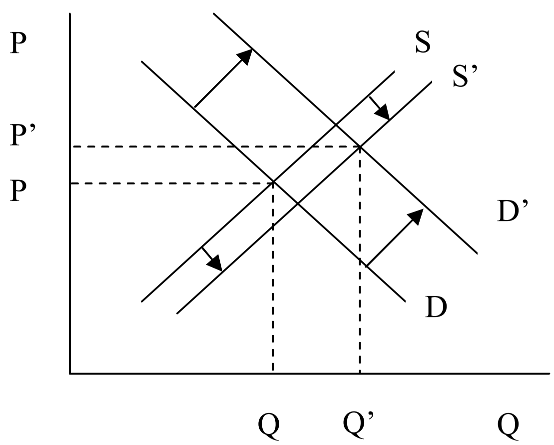
b) The frost will reduce supply raising the equilibrium price while lowering the equilibrium quantity.



c) Increasing the price of an input for a cup of coffee will reduce supply, increasing market price and reducing market quantity. This will result in the same figure as that for part c).

3. Any factor increasing demand and leaving the remainder of the market unchanged will increase both market price and quantity sold. If demand were to increase at the same time as supply changed, both market price and quantity sold could increase if the change in demand is large relative to the change in supply.





4. $$\varepsilon_{Q,P} = \frac{\%\Delta Q}{\%\Delta P} = \frac{-8}{10} = -0.80$$

5. The choke price is the price where $Q = 0$. Using the given demand curve we have

$$Q = 50 - 100P$$
$$0 = 50 - 100P$$
$$100P = 50$$
$$P = \$0.50$$

6. Speedboats could probably be categorized as a luxury item whereas light bulbs are more likely categorized as a necessity. For the necessity, the change in quantity demanded will be relatively small for any percent change in price. The change in quantity demanded may be quite large, however, for a luxury item. Since the percent change in quantity demanded is likely higher for the luxury item for any given percent change in price, the elasticity of demand would be less (more negative).

7. Because business travelers receive reimbursement for expenses, they will probably be less sensitive to price changes than the vacation traveler who pays out of her own pocket. This implies the price elasticity for vacationers would be less (more negative) than for business travelers.

8. If the prices for a particular product, such as Dannon, within a product category changes (say it increases) then it is easy for a consumer to switch to another brand, implying a relatively high percent change in quantity demanded for the product. On the other hand, if prices for the entire product category change, substitutes are not as easily found and the percent change in quantity demanded for the category will be relatively lower. This implies the elasticity for the entire product category will be higher (less negative) than the elasticity for a single product.

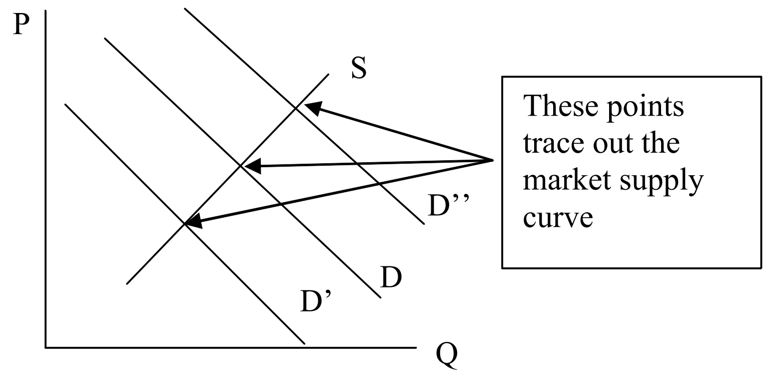
9. When the cross-price elasticity is positive we have

$$\frac{\%\Delta Q_A}{\%\Delta P_B} > 0$$

Either a) both Q_A and P_B increased or b) they both decreased. Since they are moving in the same direction, the product must be substitutes. Take coffee and tea for example; if the price of tea increases, the quantity of coffee demanded will increase.

When the cross-price elasticity is negative, Q_A and P_B are moving in the opposite direction, implying the products are complements. Take coffee and cream for example; if the price of cream increases, the quantity of coffee demanded will decrease.

10.



As the demand curve shifts, the market will reach a new equilibrium. Each new equilibrium occurs at a new price and quantity. These price/quantity combinations trace out the market supply curve. Thus, in order to identify the market supply curve one needs to observe shifts in the demand curve.

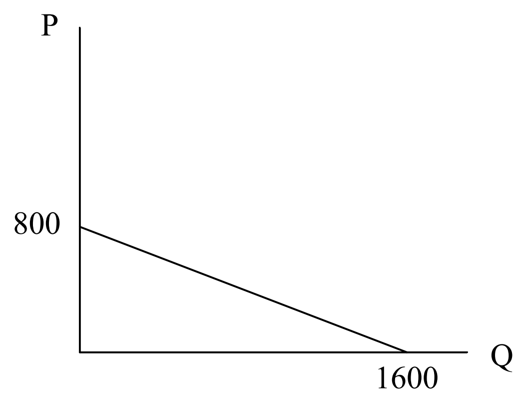
Solutions to Problems

2.1

a) When the price of nuts goes up, quantity demanded falls for all levels of price (demand shifts left). Beer and nuts are demand complements.

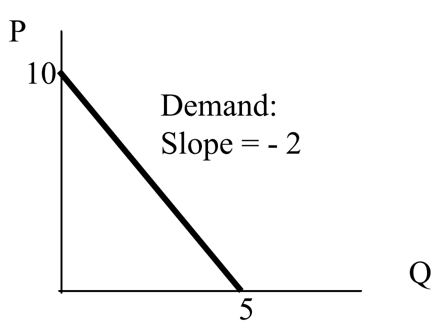
b) When income rises, quantity demanded increases for all levels of price (demand shifts rightward).

c)



2.2

a) The graph is shown below:



b) We know that the value of the price elasticity of demand is given by

$$\varepsilon_{Q,P} = \frac{\Delta Q}{\Delta P}\frac{P}{Q} = -b\frac{P}{Q}$$

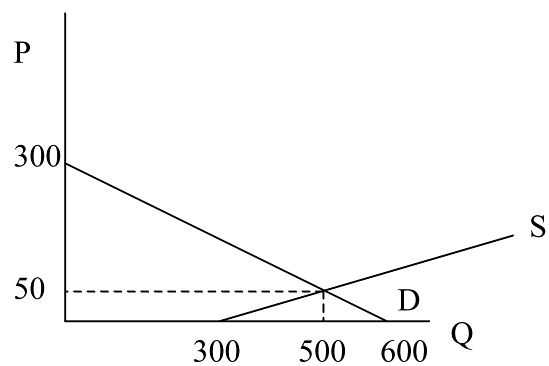
Here, –b = –1/2. For demand to be unitary elastic it must be that

$$-\tfrac{1}{2}\left[\frac{P}{5-\frac{P}{2}}\right]=-1$$

which implies that $P = 5$.

2.3

a)



b)

$$\begin{aligned}600-2P&=300+4P\\300&=6P\\50&=P\end{aligned}$$

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

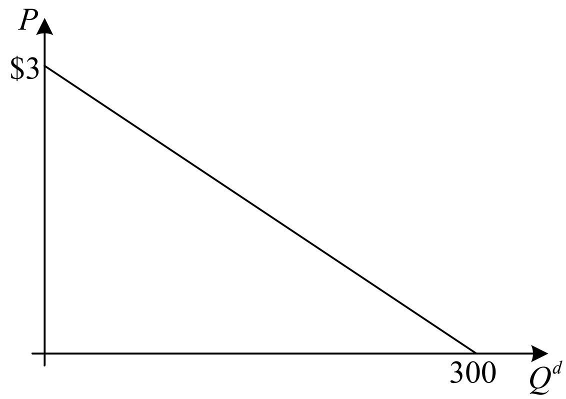
2.4.

P	0.10	0.45	0.50	0.55	2.50
Q^d	290	255	250	245	50
$\varepsilon_{Q,P}$	–0.035	–0.176	–0.2	–0.225	–5

We can find elasticities of demand using the following formula

$$\varepsilon_{Q,P}=\frac{\Delta Q^d}{\Delta P}\frac{P}{Q^d}=-100\cdot\frac{P}{300-100\cdot P}=\frac{P}{P-3}.$$

This demand curve is linear.



Observe that for price $1.50 the elasticity of demand is equal to

$$\varepsilon_{Q,P} = \frac{1.5}{1.5-3} = -1.$$

For all prices below $1.50, the demand is inelastic, while for all prices above $1.50, the demand is elastic.

2.5. Using the data from the problem we can graph the demand curve. The slope of the demand curve is equal to

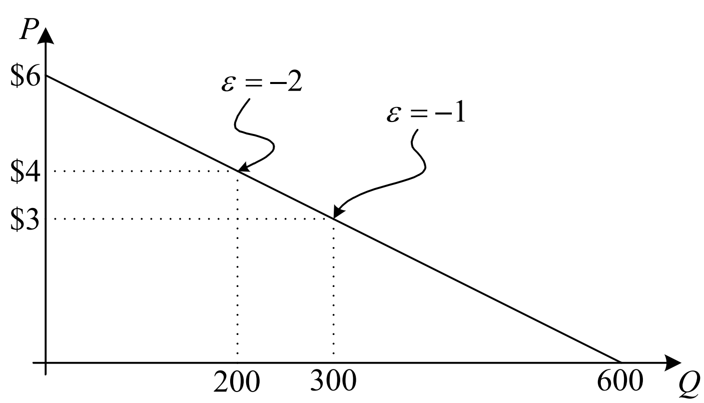
$$\Delta P / \Delta Q = -1/100$$

So the equation of the demand curve is P = A – 0.01Q.

We can find the vertical intercept A substituting P = 3 and Q = 300.

3 = A – 0.01(300), so A = 6. The vertical intercept (choke price) is P = $6.

The equation of the demand curve is then P = 6 – 0.01Q.



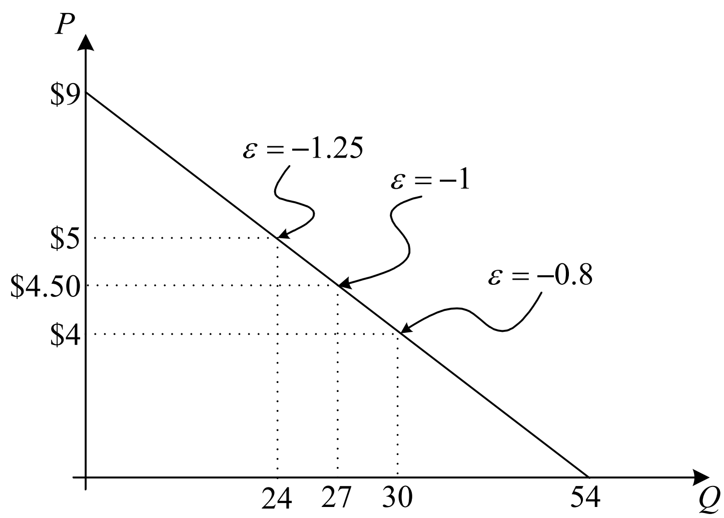
Elasticity of demand can be computed using formula

$$E_{Q,P} = \frac{\Delta Q}{\Delta P}\frac{P}{Q} = -100\frac{P}{Q} = -100\frac{6-0.01Q}{Q}$$

When the elasticity is -1, Q = 300 and P = \$3.

Thus demand is unitary elastic at a price P = \$3.

2.6. The demand for apple pies is $Q^d = 54 - 6P$.



To find the equation of the demand curve, observe that when she drops the price by \$0.50, she sells 3 more pies. So, movement along the demand occurs so that

$$\Delta Q / \Delta P = -3/0.5 = -6$$

The demand curve then has the form $Q^d = A - 6P$, where A is a constant. We can determine the value of A using any one of the three data points on the demand curve. For example, if we use the point P = 5 and Q = 24, we see that 24 = A – 6(5), so that A = 54. So the demand curve can be described by the equation $Q^d = 54 - 6P$.

To find elasticity of demand at any point on the demand curve, we use formula

$$E_{Q,P} = \frac{\Delta Q}{\Delta P}\frac{P}{Q} = -6\frac{P}{Q}$$

2.7 a) Since the price is being bid up above the official price, quantity demanded must exceed quantity supplied at the official price. This is a situation of excess demand and the official price must be below the equilibrium price.

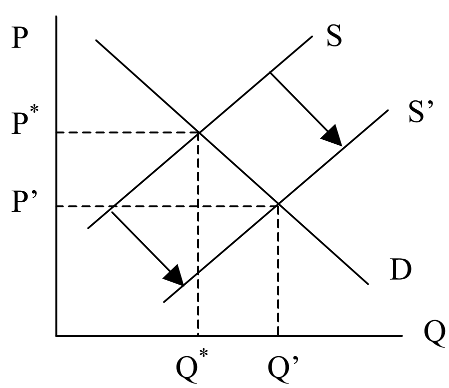
b) Lowering the official price would increase the amount of excess demand, but would have no effect on the demand or supply curves. Thus the equilibrium price would remain unchanged.

2.8 This could occur as a result of the demand curve shifting to the right, increasing both equilibrium price and quantity. This would not contradict what was learned regarding downward sloping demand curves.

2.9 The law of demand states that, holding other factors fixed, there is an inverse relationship between price and quantity demanded, i.e. that an increase in price decreases quantity and vice versa. If a good has a positive price elasticity of demand, it must be that an increase in the price of that good leads to an increase in the quantity demanded. Therefore, such a good violates the law of demand.

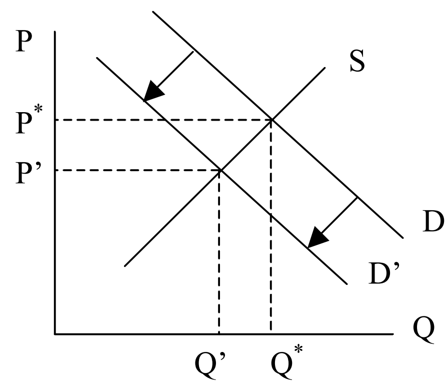
2.10

a)



An increase in rainfall will increase supply, lowering the equilibrium price and increasing the equilibrium quantity.

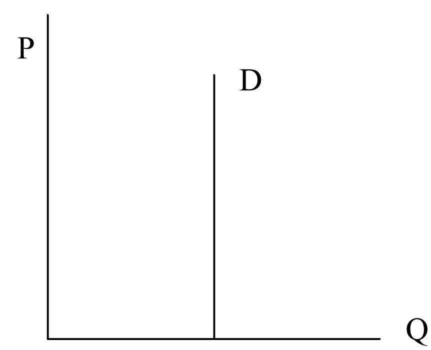
b)



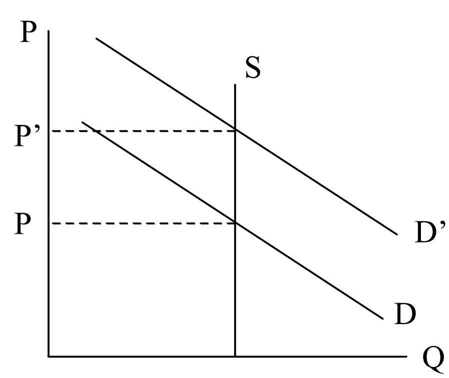
A decrease in disposable income will reduce demand, shifting the demand schedule left, reducing both the equilibrium price and quantity.

2.11

a) A perfectly inelastic demand curve will be vertical.



b) The renewed interest will shift demand to the right, raising the equilibrium price. Since supply is perfectly inelastic (and therefore vertical) there will be no change in the quantity supplied; the quantity is fixed.



2.12

a)
$$Q = 350 - 7P$$
$$7P = 350 - Q$$
$$P = 50 - \tfrac{1}{7}Q$$

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

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

2.13 Recall that for an elastic good, a higher price charged by the firm leads to a decrease in total revenue. Therefore, the firm should expect a level of output such that its revenue at a price of $102 is less than $70,000. Only if the output level is 400 or 600 is this possible (102*400 = $40,800) and (102*600 = $61,200). At the other quantities the revenue would rise.

2.14 Gina's expenditure on ice-cream is *P*Q*, where *P* is the price and *Q* is the number of units of ice cream that she buys. We know that *P*Q* increases as *P* decreases which can only mean that *Q* increases at a faster rate than the rate at which *P* decreases. This is equivalent to saying that demand is very sensitive to price changes, or that her demand for ice cream is quite elastic ($\varepsilon_{Q,P} < -1$). More generally, recall that when price and total revenue (*P*Q*) move in opposite directions, it is because demand is elastic over that price range.

2.15

a) More elastic in the long run as the theatre owner can increase space or add another screen if the price remains high, but cannot easily adjust the number of seats at short notice.

b) More elastic in the short run as people can be relatively flexible about when to undergo an eye exam, but in the long run the need for eye exams is fixed.

c) More elastic in the long run. Cigarettes tend to be addictive and so smokers are less likely to be able to reduce their demand in response to short term fluctuations in price. However if the price remains high for a long time they will consider giving up the habit as it becomes too expensive.

2.16

a) Substituting the values of *R* and *T*, we get

$$Demand: Q^d = 70 - 2P$$
$$Supply: Q^s = -14 + 5P$$

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

b) Elasticity of Demand = –2(12/46), or –0.52. Elasticity of Supply = 5(12/46) = 1.30.

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

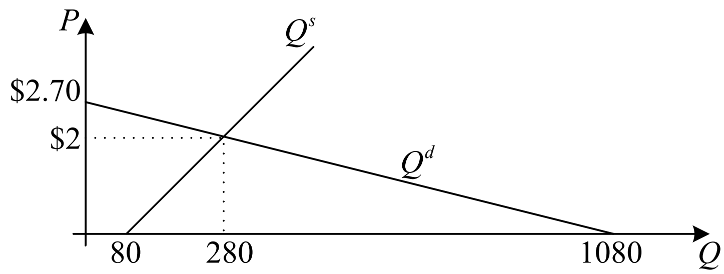
2.17

a) When the price of gasoline goes up, it becomes more expensive to drive a private automobile; because private automobiles and taxis are substitutes, the demand for taxi service should increase (shift to the right). On the other hand, when the average speed of a trip by automobile increases, commuters are more likely to use their cars instead of public transportation; the demand for taxi service should shift to the left. On the supply side, a higher price of gasoline increases to cost of providing taxi service; the supply curve for taxi service should shift to the left.

b) Substituting $G = 4$ and $E = 30$ into equations for the supply and demand curves we have

$$Q^d = 1080 - 400 \cdot P,$$
$$Q^s = 80 + 100 \cdot P.$$

Solving equation $Q^d = Q^s$ we have $P = 2$, $Q = 280$. Supply and demand curves are graphed below.



c) In equilibrium $Q^d = Q^s$. When we

$$P = \frac{1}{125}\left(200 - E + 20 \cdot G\right).$$

The equilibrium taxi fare goes up as gasoline price increases and goes down when it private automobiles can travel faster.

2.18

a) Since the two goods are rather close substitutes for each other, you would expect that the demand for Tylenol would go up if the price of Advil increases and vice versa. Therefore, the cross price elasticity will be positive.

b) Similar to part (a). Although VCRs and DVD players are not very close substitutes, if the price of VCRs were to go up substantially, potential buyers would probably decide to pay a little bit more and get the higher-end DVD player. Similarly if the latter becomes expensive, some consumers will not be able to afford it and will switch to the VCR instead. The elasticity will be positive.

c) Since the two usually go together, a sharp increase in the price of one will lead to a decline in the demand for the other, and the cross-price elasticity will be negative.

2.19

a) Assuming red and black umbrellas are substitutes, we would expect the cross-price elasticity of demand to be positive.

b) Coca-cola and Pepsi are substitutes. We would expect the cross-price elasticity of demand to be positive.

c) Grape jelly and peanut butter are typically complements (people want both on their sandwiches!). We would expect the cross-price elasticity of demand to be negative.

d) Chocolate chip cookies and milk are typically complements (people want to consume them together). We would expect the cross-price elasticity of demand to be negative.

e) Computers and software are complements (consumers want to use them together). We would expect the cross-price elasticity of demand to be negative.

2.20

a)
$$Q_U^d = 10000 - 100(300) + 99(300)$$
$$Q_U^d = 9700$$

Using $P_U = 300$ and $Q_U^d = 9700$ gives

$$\varepsilon_{Q,P} = -100\left(\frac{300}{9700}\right) = -3.09$$

b) Market demand is given by $Q^d = Q_U^d + Q_A^d$. Assuming the airlines charge the same price we have

$$Q^d = 10000 - 100P_U + 99P_A + 10000 - 100P_A + 99P_U$$
$$Q^d = 20000 - 100P + 99P - 100P + 99P$$
$$Q^d = 20000 - 2P$$

When $P = 300$, $Q^d = 19400$. This implies an elasticity equal to

$$\varepsilon_{Q,P} = -2\left(\frac{300}{19400}\right) = -.0309$$

2.21 We know that along a linear demand curve

$$\varepsilon_{Q,P} = -b\left(\frac{P}{Q}\right)$$

Using the given information this implies

$$-.5 = -b\left(\frac{.05}{10,000,000}\right)$$
$$b = 100,000,000$$

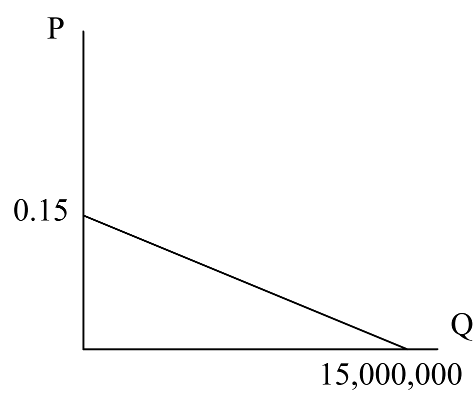
Plugging this result into a demand equation using the known price and quantity then implies

$$Q^d = A - bP$$
$$10,000,000 = A - 100,000,000(.05)$$
$$A = 15,000,000$$

So a demand equation that fits this information is given by

$$Q^d = 15,000,000 - 100,000,000P$$

Graphically, the demand curve looks like



2.22

a) In case of the linear demand $Q = A - bP$, we know that $\varepsilon_{Q,P} = -b\frac{P}{Q} = -1$

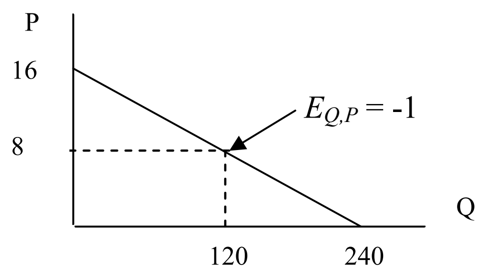
Using the values of P and Q given in the problem we have

$$-1 = -b\frac{8}{120} \quad \Rightarrow \quad b = \frac{120}{8} = 15.$$

Now we can solve for the second parameter of the linear demand curve

$$120 = a - 15(8) \quad \Rightarrow \quad a = 240.$$

Hence the linear demand curve is given by equation $Q^d = 240 - 15P$.



b) There exist several linear demand curves for which the demand is equal to 120 at price of $8. Information about elasticity of demand lets us determine exactly one of those. More formally, we need second equation to solve for both parameters of the linear demand curve.

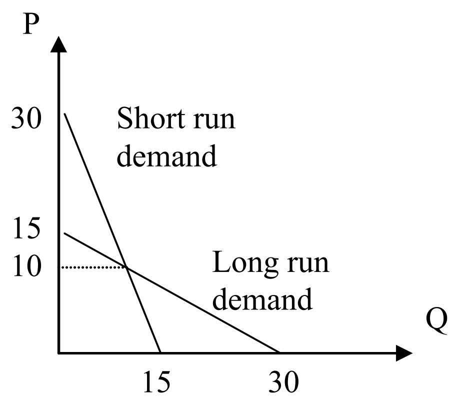
2.23

a) Butter has some reasonably close substitutes such as margarine or cheese, while eggs have no immediate substitutes. Therefore we would expect the demand for butter to be more elastic.

b) Vacation trips are sensitive to price because leisure travelers can be relatively flexible about when to fly. Your congressman, however, has fixed dates on which to be in Washington and would be prepared to pay more to ensure that he flies on the day of his choosing. Therefore, demand for vacation trips is likely to be more elastic (i.e. the price elasticity will be more negative) than the demand for trips by your congressman.

c) As discussed in the chapter, market level elasticities tend to be lower (less negative) than the elasticity of a particular brand. Thus, expect the demand for Tropicana to be more elastic than the demand for generic orange juice.

2.24 First, consider each demand curve in its "inverse" form: long run demand is $P = 15 - 0.5Q$, and short run demand is $P = 30 - 2Q$. Thus, the slope of the long run demand is –0.5, which is closer to zero than that of the short run demand, –2. Thus, long run demand is flatter. Second, consider the graph below:



Again, long run demand is flatter and thus more sensitive to changes in price. Consider, for instance a price of \$10. Quantity demanded is equal in both the long and short runs at $P = 10$. However, consider increasing the price to, say, \$15. Although this will reduce quantity demanded in the short run by a little, it would reduce quantity demanded all the way to zero in the long run.

2.25 The scare in 1999 would shift demand to the left, identifying a second point on the supply curve. The information implies that price fell \$0.50 while quantity fell 1.5 million. This implies

$$b = \frac{-.5}{-.15} = \frac{1}{3}$$

Using a linear supply curve we then have

$$P = a + \frac{1}{3}Q^s$$
$$5 = a + \frac{1}{3}(4)$$
$$a = \frac{11}{3}$$

Finally, plugging these values for a and b into the supply equation results in

$$P = \frac{11}{3} + \frac{1}{3}Q^s$$
$$3P = 11 + Q^s$$
$$Q^s = -11 + 3P$$

The floods in 2000 will reduce supply. The shift in supply will identify a second point along the demand curve. Because the scare of 1999 is over, assume that demand has returned to its 1998 state. The change in price and quantity in 2000 imply that price increased \$3.00 and that quantity fell 0.5 million.

Performing the same exercise as above we have

$$-b = \frac{3}{-0.5} = -6$$

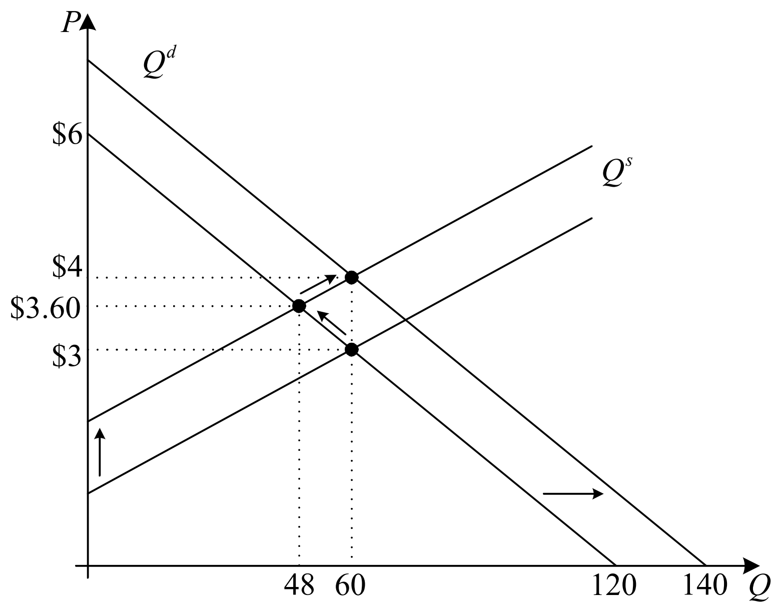
Using the 1998 price and quantity information along with this result yields

$$\begin{aligned} P &= a - bQ^d \\ 5 &= a - 6(4) \\ a &= 29 \end{aligned}$$

Finally, plugging these values for a and b into a linear demand curve results in

$$\begin{aligned} P &= 29 - 6Q^d \\ 6Q^d &= 29 - P \\ Q^d &= \frac{29}{6} - \frac{1}{6}P \end{aligned}$$

2.26 The equilibrium price in January is equal to $P = 3$ and equilibrium quantity is equal to $Q = 60$. We find equilibrium price by solving $Q^s = Q^d$, which is $30 \cdot P - 30 = 120 - 20 \cdot P$. When we have equilibrium price we can substitute it to either the demand function or supply function, since they have to give the same quantity at that price, and obtain equilibrium quantity equal to $Q = 60$. After the supply decreases in February, new equilibrium price is per mile is equal to $P = \$3.60$, while the demanded quantity is equal to $Q = 48$. When the demand goes up in March, the quantity in equilibrium is the same as in January but price is even higher and equal to $P = \$4$. All those changes are illustrated on the graph below.


P
Q^d
$6
Q^s
$4
$3.60
$3
48
60
120
140
Q

