Problem Set 2 – Chapter 2 Problems

1. Ch 2, Problem 2.1
   The demand for beer in Japan is given by the following equation: \( Q^d = 700 - 2P - P_N + 0.1I \), where \( P \) is the price of beer, \( P_N \) is the price of nuts, and \( I \) is average consumer income. Assume B is a normal good.

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

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

   c. Graph the demand curve for beer when \( P_N = 100 \) and \( I = 10,000 \). Label axis with \( P \) on the vertical axis and \( Q \) on the horizontal axis. Indicate at what points the demand curve touches the price and quantity axis.

2. Ch 2, Problem 2.3
   The demand and supply curves for coffee are given by \( Q^d = 600 - 2P \) and \( Q^s = 300 + 4P \).

   a. Plot the supply and demand curves on a graph and show where the equilibrium occurs by marking it with an E. Label the point at which either curve touches the P or Q axis. Remember price is always on the vertical axis.

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

3. Ch 2, Problem 2.13
   Consider a linear demand curve, \( Q = 350 - 7P \).

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

   b. What is the choke price?

   c. What is the price elasticity of demand at \( P = 50 \)?

4. Ch 2, Problem 2.17
   Consider the following demand and supply relationships in the market for golf balls: 
   \( Q^d = 90 - 2P - 2T \) and 
   \( Q^s = -9 + 5P - 2.5R \),
where $T$ is the price of titanium, a metal used to make golf clubs, and $R$ is the price of rubber.

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

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

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

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

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

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

and the quantity of $X$ demanded by individual 2 is

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

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

b. Using the individual demand curves obtained in part b, graph the market demand curve for total $X$. Note at what price and quantity there is a kink in the market demand curve.

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

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

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

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

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

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

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

where $R$ is the amount of rainfall.
c. On the same graph you drew for part b, graph the supply curve for lychees when \( R = 50 \). Label the equilibrium price and quantity with \( P^* \) and \( Q^* \) respectively.

d. Calculate the equilibrium price and quantity of lychees.

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

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

7. Consider the demand curve \( Q = aP^{-b} \), where \( a \) and \( b \) are positive constants, this is the formula for the constant elasticity function we discussed in class. Use the formula for price elasticity of demand given in class,

\[
\varepsilon_{Q,P} = \frac{\partial Q}{\partial P} \frac{P}{Q},
\]

to show that the price elasticity of demand is equal to \( -b \) at every point on the demand curve (i.e. do the calculus).