Question 1  (a) The equilibrium price and quantity are

\[ P^* = 8 \text{ and } Q^* = 14 \]

(b) The new equilibrium price and quantity are

\[ P^* = 6 \text{ and } Q^* = 12 \]

Question 2  If demand is \( Q_D = a - bP \), then \( \epsilon_D = -bP/Q \). Thus, \(-0.1 = -bP/Q = -10b/50 = 0.2b \), i.e., \( b = -1 \). Thus, \( Q_D = a - P \). Since \( Q_D(10) = 50 \), we get \( 50 = a - 10 \) and hence \( a = 40 \). Thus, the demand function is given by

\[ \text{the price of good 1 is } Q_D(P) = 40 - P \]

Question 3  Changing consumption from \((20, 30)\) to \((18, 40)\) means that \( \Delta x_1 = -2 \) and \( \Delta x_2 = 10 \). The slope of the budget line is therefore \( \Delta x_2/\Delta x_1 = -5 \). We know that the slope of the budget line is also given by \( p_1/p_2 \). Thus,

\[ p_2 = 2.4. \]
Question 4  (a) In equilibrium, \( Q_D(P) = 100 - 4P - 4\tau = 10 + P = Q_S(P) \). Thus, 
\[
P = 18 - 0.8\tau.
\]
The quantity is 
\[
Q^*(\tau) = 28 - 0.8\tau.
\]

(b) The tax revenue is \( R(\tau) = 28\tau - 0.8\tau^2 \). This is maximized if \( R'(\tau) = 0 \). Thus, \( 28 - 1.6\tau = 0 \).

The revenue maximizing tax is given by \( \tau^* = 35 \).

Question 5

\[
x_S = 4, \ x_C = 32.
\]
Question 6

\[ x_1 = 8, x_2 = 20. \]
Question 7 (b) \[ x_1 = 5, \ x_2 = 20. \]

(c) \[ x_1 = 39, \ x_2 = 0. \]

Question 8 (a) \[ \epsilon_P^{D} = \frac{-AP}{1000-AP}. \]

Taking the derivative of \( \epsilon_P^{D} \) with respect to \( A \) we get (recall that \( \left(\frac{u}{v}\right)' = \frac{u'v - uv'}{v^2} \)).

\[ \frac{\partial \epsilon_P^{D}}{\partial A} = \frac{-P}{1000-AP}. \]

This derivative is negative.
(b) In equilibrium $Q_s(P + s) = 0.2(P + s) = 1,000 - AP$. Thus,

\[ P^* = \frac{5,000 - S}{5A + 1}. \]

(c) Note that \( \frac{\partial P^*(A, s)}{\partial s} = -\frac{25,000 - 5S}{5A + 1} < 0 \) since the subsidy decreases the price. Note that \( A \) appears only in the denominator. In particular, if \( A \) is increased then the denominator becomes larger, i.e., \( \left| \frac{\partial P^*(A, s)}{\partial s} \right| \) is decreased. Thus, a more elastic demand result in a smaller price response when the subsidy is introduced.