Question 1  Demand is unit elastic, i.e., the price elasticity is \(-1\) if \(P = 2.5\).

The price elasticity of demand is \(\varepsilon^P_D = \frac{2P}{10-2P} = -1\). Thus, \(2P = 10 - 2P\), i.e., \(P = 2.5\).

Question 2  Since the solution is interior we have \(\frac{2}{3} = \frac{p_1}{p_2}\), i.e., \(3p_1 = 2p_2\). In addition, \(10p_1 + 20p_2 = 240\). Thus, \(p_1 = 6, p_2 = 9\).

Question 3

\[
\begin{array}{c}
\text{\(x_2\)}
\end{array}
\]

\[
\begin{array}{c}
\text{\(x_1\)}
\end{array}
\]
(a) The MRS at (15, 5) is \(0.5\).  
(b) The optimal consumption is \(x_1 = 36, x_2 = 0\).

**Question 4**  
\[180 - 2P = 30 + 3P\]  
implies that the equilibrium price before the tax is \(30\).  
After the tax, \[180 - 2(P + 5) = 30 + 3P\].  
Thus, producers sell the good at a price of \(28\).  
At this price demand and supply are 114.  
Thus, the government’s tax revenue is \(570\).
Question 5 The solution is \( x_1 = 14, x_2 = 2 \).
Question 6  A person’s preferences for two goods are indicated below.

(a) Suppose the prices of the goods are original $p_1 = 2$, $p_2 = 2$ and that the person’s income is $I = 36$. Determine the optimal consumption graphically.

$x_1 = 9, x_2 = 9$.  

5 points

(b) Now suppose that the price of good 1 increases to $p_1 = 4$. Determine the least costly consumption bundle that gives the person the same utility as in (a).

$x_1 = 4, x_2 = 16$.  

5 points
(a) Suppose prices are $p_1 = p_2 = 4$ and income $I = 80$. Then optimal consumption is $x_1 = 10, x_2 = 10$. 

(b) Suppose price of good 2 increases to $p_2 = 8$ since the government introduces a tax of 4 Dollars on each unit of the good. Then after-tax consumption is $x_1 = 8, x_2 = 6$ and the government’s tax revenue is 24.

(c) Suppose the after the tax increase, the person’s income increases such that he/she can just afford the consumption from (a). Then the person’s opti-
mal consumption is $x_1 = 12, x_2 = 9$ and the government’s tax revenue is $36$.  

**Question 8** The original equilibrium is given by $1,000 - 100P = 100 + 50P$. Thus, $P = 6$. After the subsidy demand is $1.1(1,000 - 100(P - s)) = 1.1(1,000 - 600)$, since $P - s = 6$. Therefore the equilibrium price must satisfy $1.1(1,000 - 600) = 100 + 50P$, which implies $P = 6.8$. Hence $s = 0.8$. Since demand is 440, the total subsidy payment is 352.

$s = 0.8$ and the government spends 352 on the subsidy. 12 points

**Question 9 (a)** Suppose prices are originally $p_1 = 1, p_2 = 2$ and $I = 60$. Then the government imposes a tax of 2 Dollars, raising the price of good 1 to $p_1 = 3$. Then the optimal choice is $x_1 = 12, x_2 = 12$ and the government’s tax revenue is 24. 5 points

(b) In order to get the after-tax utility at prices $p_1 = 1, p_2 = 2$ the person’s income would have to be $I = 32$, and consumption would be $x_1 = 16, x_2 = 8$. 5 points

(c) The deadweight loss of the tax is 4 3 points