Question 1  Demand is unit elastic, i.e., the price elasticity is $-1$ if $P = 3.75$.  

The price elasticity of demand is $\epsilon_D^P = \frac{ AP }{ 30 - 4P } = -1$. Thus, $4P = 30 - 4P$, i.e., $P = 3.75$.

Question 2  Since the solution is interior we have $\frac{4}{3} = \frac{p_1}{p_2}$, i.e., $3p_1 = 4p_2$. In addition, $10p_1 + 20p_2 = 600$. Thus, 

$p_1 = 24, \ p_2 = 18$.  

8 points

Question 3 

![Graph of a linear programming problem with constraints and feasible region shaded in green. The objective function is represented by a dashed line.]
(a) The MRS at (5, 10) is 12. 6 points

(b) The optimal consumption is $x_1 = 0, x_2 = 28$. 6 points

**Question 4** 200 – 2P = 100 + 3P implies that the equilibrium price before the tax is 20. After the tax, 200 – 2(P + 5) = 100 + 3P. Thus, producers sell the good at a price of 18. At this price demand and supply are 154. Thus, the government’s tax revenue is 770. 10 points
Question 5  The solution is $x_1 = 5, x_2 = 20$.  

13 points
Question 6  A person’s preferences for two goods are indicated below.

(a) Suppose the prices of the goods are original $p_1 = 2, p_2 = 1$ and that the person’s income is $I = 48$. Determine the optimal consumption graphically.

\[ x_1 = 16, \ x_2 = 32. \]  

5 points

(b) Now suppose that the price of good 2 increases to $p_2 = 2$. Determine the least costly consumption bundle that gives the person the same utility as in (a).

\[ x_1 = 18, \ x_2 = 18. \]  

5 points
Question 7  Income offer curves are depicted below

(a) Suppose prices are \( p_1 = p_2 = 2 \) and income \( I = 60 \). Then optimal consumption is \( x_1 = 15, x_2 = 15 \). 4 points

(b) Suppose price of good 1 increases to \( p_2 = 6 \) since the government introduces a tax of 4 Dollars on each unit of the good. Then after-tax consumption is \( x_1 = 6, x_2 = 12 \) and the government’s tax revenue is 48. 4 points

(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 optimal
consumption is $x_1 = 12, x_2 = 24$ and the government’s tax revenue is $96$.  

**Question 8** The original equilibrium is given by $1,000 - 30P = 800 + 20P$. Thus, $P = 4$. After the subsidy demand is $1.1(1,000 - 30(P - s)) = 1.1(1,000 - 120)$, since $P - s = 6$. Therefore the equilibrium price must satisfy $1.1(1,000 - 120) = 800 + 20P$, which implies $P = 8.4$. Hence $s = 4.4$. Since demand is 1,600, the total subsidy payment is 7,040.

$s = 4.4$, and the government spends $7,040$ on the subsidy.  

**Question 9 (a)** Suppose prices are originally $p_1 = 3, p_2 = 2$ and $I = 72$. Then the government imposes a tax of 4 Dollars on good 2, raising the price to $p_2 = 6$. Then the optimal choice is $x_1 = 12, x_2 = 6$, and the government’s tax revenue is $24$.  

(b) In order to get the after-tax utility at prices $p_1 = 3, p_2 = 2$ the person’s income would have to be $I = 45$, and consumption would be $x_1 = 9, x_2 = 9$.  

(c) The deadweight loss of the tax is $3$.  
