All questions must be answered on this test form!  
For each question you must show your work and (or) provide a clear argument.  
All graphs must be accurate to get credit.

**Question 1** Consumer preferences are depicted below:

1. Since \( (6, 10) \) is the optimal consumption, we must have \( MRS = \frac{p_1}{p_2} \). Thus, \( \frac{5}{3} = \frac{30}{p_2} \), i.e., \( p_2 = 18 \).

   Then \( p_2 = 18, I = 360 \)

2. If prices are \( p_1 = 1, p_2 = 3 \), then it is optimal only to consume good 1. Then the minimum amount of income the person needs to get the same utility as \( (3, 5) \) is given by \( I = 6 \).

3. If \( p_1 = 3 \) and \( p_2 = 1 \), then it is only optimal to consume good 2. Thus, the optimal consumption is \( x_1 = 0, x_2 = 15 \).
Question 2  Demand is given by \( Q_D(P) = 100 - P \), and supply is \( Q_S(P) = 20 + 3P \).

(a) The equilibrium price and quantity are
\[
P = 20, \quad Q = 80\.
\]

(b) Supply is \( Q_S(14) = 62 \). Thus, \( Q_D(P) = 62 \) implies \( P = 38 \).
\[
P = 38, \quad Q = 62\.
\]

(c) Demand is \( Q_D(P - s) = Q_D(14) = 86 \). Therefore \( Q_S(P) = 86 \). Hence, \( P = 22 \).
Therefore \( 22 - s = 14 \) implies \( s = 8 \).
The subsidy is \( s = 8 \).

Question 3

(a) Let \( Q_D(P) = a - bP \). Then \( \epsilon_D = -bP/Q \). Thus, \(-2 = -5b/40\). Hence, \( b = 16 \).
Thus, \( 40 = Q_D(5) = a - 80 \). Hence, \( a = 120 \).
\[
Q_D(P) = 120 - 16P\.
\]

(b) Suppose the demand function is given by \( Q_D(P) = 30 - 5P \). Thus, \(-1 = -5p/(30 - 5P)\), which implies \( P = 3 \).
\[
P = 3\.
\]

(c) Let \( Q_D(P) = a - bP \), then \( 20 = a - 8b \) and \( 14 = a - 12b \). Thus, \( a = 32 \) and \( b = 1.5 \). Hence the demand function is \( Q(P) = 32 - 1.5P \). The price elasticity of demand is therefore \( \epsilon_D = -1.5P/(32 - 1.5P) = -3 \). Thus,
\[
P = 16\.
\]
Question 4

(a) The optimum is $x_1 = 6, x_2 = 18$.

(b) $x_1 = 3, x_2 = 9$. 
Question 5 Determine the optimum graphically. *Indicate the feasible set by shading it!*

At an optimum $x_1 = 14, x_2 = 12$
Question 6  The after-tax demand is $x_1 = 5, x_2 = 5$

The government’s tax revenue is 40

The least costly consumption bundle that gives the consumer the after tax utility at the pre-tax prices is $x_1 = 0, x_2 = 20$

and the cost of this consumption bundle (at pre-tax prices) is $I = 40$

The deadweight loss of the tax is therefore 20
Question 7  The optimal consumption is $x_1 = 10, x_2 = 10$

At a price of $p'_1 = 2.5$, the person would be able to afford $(12, 0)$ which would be the optimal consumption choice.

$p'_1 = 2.5$
**Question 8** Preferences are depicted below.

**optimal consumption is** $x_1 = 30, x_2 = 0$

The person needs and income of at least $I = 81$. 

![Graph showing optimal consumption and income](image)