Question 1 Consumer preferences are depicted below:

1. Since $(4, 9)$ is the optimal consumption, we must have $\text{MRS} = \frac{p_1}{p_2}$. Thus, 
   $$1.5 = \frac{12}{p_2}, \text{ i.e., } p_2 = 8.$$ 
   Then $p_2 = 8, I = 120$

2. If prices are $p_1 = 3, p_2 = 1$, then it is optimal only to consume good 2. Then the minimum amount of income the person needs to get the same utility as $(10, 6)$ is given by $I = 21$

3. If $p_1 = 1$ and $p_2 = 2$, then it is only optimal to consume good 1. Thus, the optimal consumption is $x_1 = 16, x_2 = 0$. 

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 2** Demand is given by \( Q_D(P) = 100 - 2P \), and supply is \( Q_S(P) = 20 + 3P \).

(a) The equilibrium price and quantity are

\[
P = 16, \ Q = 68
\]

(b) Supply is \( Q_S(13) = 59 \). Thus, \( Q_D(P) = 59 \) implies \( P = 20.5 \).

\[
P = 20.5, \ Q = 59
\]

(c) Demand is \( Q_D(P-s) = Q_D(13) = 74 \). Therefore \( Q_S(P) = 74 \). Hence, \( P = 18 \).

Therefore \( 18 - s = 13 \) implies \( s = 5 \).

The subsidy is \( s = 5 \).

**Question 3**

(a) Let \( Q_D(P) = a - bP \). Then \( \epsilon_D = -bP/Q \). Thus, \(-0.5 = -5b/40 \). Hence, \( b = 4 \).

Thus, \( 40 = Q_D(5) = a - 20 \). Hence, \( a = 60 \).

\[
Q_D(P) = 60 - 4P
\]

(b) Suppose the demand function is given by \( Q_D(P) = 20 - 4P \). Thus, \(-1 = -4p/(20 - 4P) \), which implies \( P = 2.5 \).

Determine the price \( P \) at which the price elasticity of demand is \(-1\).

\[
P = 2.5
\]

(c) Let \( Q_D(P) = a - bP \), then \( 20 = a - 10b \) and \( 14 = a - 20b \). Thus, \( a = 26 \) and \( b = 0.6 \). Hence the demand function is \( Q(P) = 26 - 0.6P \). The price elasticity of demand is therefore \( \epsilon_D = -0.6P/26 - 0.6P = -3 \). Thus,

\[
P = 32.5
\]
**Question 4** Suppose preferences are given by \( u(x_1, x_2) = \min\{x_1, 2x_2\} \). Prices are given by \( p_1 = 2, p_2 = 1 \). Income is \( I = 25 \). In both cases below you must draw the budget line (iso cost curve) and the indifference curve through the solution.

(a) The optimum is \( x_1 = 10, x_2 = 5 \).

(b) \( x_1 = 14, x_2 = 7 \).
Question 5
Determine the optimum graphically. *Indicate the feasible set by shading it!*

At an optimum \( x_1 = 18, x_2 = 8 \)
Question 6

The after-tax demand is $x_1 = 10, x_2 = 10$

The government’s tax revenue is 20

The least costly consumption bundle that gives the consumer the after tax utility at the pre-tax prices is

$x_1 = 0, x_2 = 30$

and the cost of this consumption bundle (at pre-tax prices) is $I = 30$

The deadweight loss of the tax is therefore 10
Question 7: The optimal consumption is $x_1 = 9, x_2 = 14$

At a price of $p'_1 = 3.75$, the person would be able to afford $(16, 0)$ which would be the optimal consumption choice.

$p'_1 = 3.75$
Question 8 Preferences are depicted below.

Suppose that prices are $p_1 = 2$, $p_2 = 3$ and income is $I = 30$. Then

\[ \text{optimal consumption is } x_1 = 15, x_2 = 0 \]

Suppose that prices are $p_1 = 4$, $p_2 = 3$, and the person wants to obtain the same utility as (10, 10). Hicksean demand is (0, 15). The person needs and income of at least $I = 45$. 

\[ 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 \]

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