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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 

(a) Suppose that demand $Q_D(P)$ is linear; that $Q_D(10) = 40$; and the price elasticity of demand at $P = 10$ is $-0.1$. Then the demand function is given by 

$$Q_D(P) = a - bP.$$ 

Demand is of the form $Q_D(P) = a - bP$. The price elasticity is given by $-bP/Q$. Thus, $-10b/40 = -0.2$. Thus, $10b = 8$, i.e., $b = 0.8$. Therefore, $40 = Q_D(10) = a - 8$. Thus, $a = 48$. Hence, 

$$Q_D(P) = 48 - 0.8P.$$ 

(b) Suppose that a supply function is given by $Q_S(P) = 10P^3$. Then 

$$Q'_S(P) = 30P^2.$$ 

Thus, $\epsilon_S = 30P^3/(10P^3) = 3$. 

The price elasticity of supply is
Question 2 Suppose that demand for gasoline is \( Q_D(P) = 5 - 0.3P \) and that supply is \( Q_S(P) = 3 + 0.2P \). Suppose that because of a recession demand is reduced by 10%. Then:

- Originally (before the recession) the price is $ \[ \text{.} \]
- After the demand shock the price is $ \[ \text{.} \]
- Thus, the price decreases by \( \% \) \[ \text{.} \]

Note: both solutions are not necessarily integers.

Before the recession, the equilibrium price is satisfies \( 5-0.3P = 3 + 0.2P \). Thus, \( 0.5P = 2 \), i.e., \( P = 4 \). After the recession, we have \( 0.9(5-0.3P) = 3+0.2P \). Thus, \( 4.5-0.27P = 3+0.2P \), which implies \( 1.5 = 0.47P \). Thus, \( P = 3.19 \). The price drops by about 20%.

- Originally (before the recession) the price is $4 \[ \text{.} \]
- After the demand shock the price is $3.19 \[ \text{.} \]
- Thus, the price decreases by 20\% \[ \text{.} \]
**Question 3** Demand and supply curves are depicted below. Suppose the government subsidizes suppliers by paying them 8 Dollars for each unit. Then 12 points

The equilibrium quantity is

The price excluding the subsidy is

If the government did not subsidize, the equilibrium price would be
Question 4 Suppose there are two inputs, $x_1$, $x_2$, for production and the firm wants to produce 10 units of output. In order to do so, we must have $x_1 \geq 3$, $x_2 \geq 8$, $x_1 + x_2 \geq 24$, and $2x_1 \leq x_2$. Each unit of input 1 costs 6 Dollars and each unit of input 2 costs 2 Dollars. Solve the optimization problem graphically. Indicate the feasible set by shading it. Also graph at least three lines that represent the objective, i.e., the iso cost curves. 15 points

The cost minimizing inputs are $x_1 = $, $x_2 = $.

The firm’s minimum cost is
Question 5 A utility function is given by \( u(x_1, x_2) = \min\{5x_1, 3x_2\} \). Suppose that prices are \( p_1 = 1 \) and \( p_2 = 2 \). The person's income is \( I = 26 \). Determine the optimal choice graphically. Graph at least three indifference curves, including the one through the optimal choice point.

At the optimal choice, \( x_1 = \) \( x_2 = \) 12 points

\[ x_2 \]

\[ x_1 \]
Question 6  Some indifference curves are depicted below. Suppose that \( p_1 = 6, p_2 = 10 \) and income \( I = 160 \).

At the optimal choice, \( x_1 = \quad x_2 = \quad 12 \text{ points} \)

Suppose \( p_1 \) increases to \( p_1 = 15 \). What is the minimum amount of money to get the same utility level as before the price increase? What are \( x_1 \) and \( x_2 \) that minimize expenditures?

At the optimal choice, \( x_1 = \quad x_2 = \quad , I = \quad \)
Question 7 A consumer’s preferences are depicted below. Originally, prices are \( p_1 = 2 \), \( p_2 = 8 \) and the person’s income is \( I = 56 \). Then the government decides to impose a tax of 2 Dollars on each unit of good 1, i.e., the after-tax price is \( p_1 = 4 \) and the government receives 2 Dollars for each unit purchased by the consumer. Then 

The government’s tax revenue is

Suppose that the government uses instead a lump sum tax of \( t \) Dollars (i.e., prices are \( p_1 = 2 \), \( p_2 = 8 \) and income is \( I - t \)). Tax \( t \) is chosen such that the consumer’s utility is the same as that after the 2 Dollar per unit tax. Then 

\[
t = 
\]
Question 8  Suppose a consumer’s preferences are given by $u(x_1, x_2) = 2x_1 + 5x_2$. Prices are $p_1 = 4$ and the optimal consumption is $(20, 10)$. Then

\[
\begin{align*}
  p_2 & = \quad \text{and } I = \quad \\
\end{align*}
\]

(You can use the grid below to help you answer the question. However, anything graphed below will not be graded.) 12 points

Since these are perfect substitute preferences and the optimal choice is interior, the MRS must equal the price ratio, i.e., $2/5 = 4/p_2$. Thus, $p_2 = 10$. Hence,

\[
\begin{align*}
  p_2 = 10 \quad \text{and } I = 180
\end{align*}
\]