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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 Suppose that $p_1 = 6$ and that both (20, 14) and (12, 18) are on the budget line. Then the equation of the budget line is given by

$$Q = \text{ } .$$

8 points

Question 2 Suppose that a linear demand function has a price elasticity of -0.2 at $P = 4$. Furthermore, at a price of $P = 10$ demand is 14 units. Then the equation of the demand curve is given by

$$Q_D(P) = \text{ } .$$

10 points
Question 3

(a) A utility function is \( u(x_1, x_2) = \min\{4x_1 + x_2, 2x_1 + 3x_2\} \). Graph the indifference curve through \((12, 2)\) using the grid above. The MRS at \((12, 2)\) is \(6 \text{ points}\).

(b) Suppose prices are \( p_1 = 1 \), \( p_2 = 3 \), and \( I = 30 \). Determine the optimal consumption graphically. Clearly indicate the budget set by shading it and draw the indifference curve through the optimal consumption. The optimal consumption is \( x_1 = \), \( x_2 = \). \(6 \text{ points}\).
Question 4: Suppose the demand for a good is \( Q_D(P) = 200 - 2P \) while supply is \( Q_S(P) = 100 + 2P \). Suppose the government provides a subsidy of 4 Dollars per unit to producers, resulting in a supply function of \( Q_S(P) = 100 + 2(P + 4) \). Then the equilibrium price before the subsidy is introduced is \[ \text{equilibrium price before the subsidy is introduced} \]. After the subsidy consumers by the product at a price of \[ \text{equilibrium price after the subsidy} \]. The government spends \[ \text{amount spent on the subsidy} \] on the subsidy.

Question 5: A firm uses two inputs \( x_1, x_2 \) in production and wants to minimize costs subject to a number of technological constraints. In particular, the firm solves

\[
\min_{x_1, x_2} x_1 + 2x_2 \text{ subject to}
\]

\[
\begin{align*}
(1) & \quad x_1 + 3x_2 \geq 30; \\
(2) & \quad 2x_1 + x_2 \geq 30; \\
(3) & \quad x_1 + x_2 \geq 12; \\
(4) & \quad x_1 - 7x_2 \leq 0; \\
(5) & \quad x_1 - 2x_2 \geq 0; \\
(6) & \quad x_1 \geq 0; \\
(7) & \quad x_2 \geq 0; 
\end{align*}
\]

Determine the optimal optimal choice of \( x_1 \) and \( x_2 \), graphically (using the grid on the next page). Clearly indicate the feasible set by shading it. You must also graph three lines that represent the objective, including the line through the solution.

The solution is \( x_1 = \), \( x_2 = \).
Question 6 Solve the questions below graphically using the preferences in the grid.

(a) Suppose that $p_1 = p_2 = 1$ and income is $I = 24$. Then optimal consumption is

\[ x_1 = \quad , \quad x_2 = \quad \]

5 points

(b) Now suppose that the price of good 2 increases to $p_2 = 4$. Then the least costly consumption bundle that gives the person the same utility as in (a) is

\[ x_1 = \quad , \quad x_2 = \quad \]

5 points
Question 7 Income offer curves and indifference curves are depicted below

(a) Suppose prices are $p_1 = 1$, $p_2 = 2$ and income $I = 40$. Then optimal consumption is $x_1 = \underline{\quad}$, $x_2 = \underline{\quad}$.  

(b) Then the government imposes a tax of 3 Dollars per unit of good 1, raising the price of good 1 to $p_1 = 4$. The optimal consumption after the tax is $x_1 = \underline{\quad}$, $x_2 = \underline{\quad}$.

(c) Solve the expenditure minimization problem for prices $p_1 = 4$, $p_2 = 2$ that gives the person the same utility as in (b).
Then $x_1 = \underline{\phantom{0}}$, $x_2 = \underline{\phantom{0}}$, and $I = \underline{\phantom{0}}$.

(d) The government’s tax revenue is $\underline{\phantom{0}}$ and the deadweight loss of the tax is therefore $\underline{\phantom{0}}$.

(e) Solve the expenditure minimization problem for prices $p_1 = 4$, $p_2 = 2$ that gives the person the same utility as in (a). Then $x_1 = \underline{\phantom{0}}$, $x_2 = \underline{\phantom{0}}$, and $I = \underline{\phantom{0}}$.

Suppose the person receives a lump sum subsidy to get this income level. Then the government’s tax revenue is $\underline{\phantom{0}}$. Thus, the required subsidy exceeds the tax revenue by $\underline{\phantom{0}}$. 5 points
Question 8 Suppose that in a particular country the demand for gasoline is $Q_D(P) = 1,000 − 30P$, and supply is $Q_S(P) = 800 + 20P$. Each year more people in the country buy cars, and as a consequence, the demand function is expected to shift up by 10% next year, i.e., next year’s demand is $1.1Q_D(P)$. The government wants to provide a subsidy $s$ for consumers, so that the price including the subsidy remains constant (i.e., if $P_1$ and $P_2$ are the equilibrium prices for this year and next year, respectively, then $P_1 = P_2 − s$). Note that after the subsidy, demand is $1.1Q_D(P − s)$ (where $P$ is the price).

The government provides a subsidy $s = \underline{0}$, and the government spends \underline{0} on the subsidy. \hspace{1cm} 12 points