Mid-term I Econ500, (Yellow)  
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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 budget line is depicted below

1. Suppose income decreases by 50%. Graph the new budget line.  
2. Suppose that at the same time as income increased, the price of good 2 decreases by 50%. Graph the budget line.  
3. Consider again the original budget line depicted above. Suppose that income is \( I = 160 \). Then

\[
p_1 = \quad , \quad p_2 = \quad
\]

3 points

3 points

4 points

1
Question 2 Preferences are indicated below by indifference curves

\[ x_2 \]

1. Circle the correct statements 6 points

- \((18, 15) \succeq (5, 5)\)
- \((14, 10) \succ (10, 14)\)
- \((24, 0) \succeq (0, 24)\)
- \((24, 0) \succeq (0, 20)\)
- \((6, 2) \succ (0, 10)\)
- \((7, 12) \succ (12, 7)\)

2. Answer the following questions 4 points

- \(\text{MRS}(12, 18) = \)
- \(\text{MRS}(2, 14) = \)

3. Suppose that \((12, 4)\) is the optimal consumption choice. If the price of good 1 is 12 then 4 points

- \(p_2 = \)
- \(\text{and income is } I = \)
Question 3  A bank can allocate its funds in illiquid long term investments $x_L$, with an annualized rate of return of 10% or in in short term investments $x_S$ (treasury bills) that pay 5% interest, i.e., the bank’s objective is to maximize $0.05x_S + 0.1x_L$. Suppose that the bank has 30 (Million) Dollars in assets that it can invest, i.e., $x_S + x_L \leq 30$. The bank needs to keep at least 5 Million Dollars in treasury bills, to be able to satisfy liquidity demand by depositors, $x_S \geq 5$. Further, bank regulation requires that for every 4 Dollars in long term investments, the bank must hold 1 Dollar in short term investments, i.e., $x_S \geq (1/4)x_L$. However, at the same time the bank cannot allocate less than 2 Dollars to the illiquid investments for each Dollar of liquid investments, since the bank is required to provide loans to the local business community, $x_L \geq 2x_S$.

Solve the optimization problem graphically. *Indicate the feasible set by shading it!*

<table>
<thead>
<tr>
<th>The bank should choose $x_S =$</th>
<th>$x_L =$</th>
</tr>
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</table>

The bank’s profit (value of objective) is Million Dollars 12 points

*Grid for graph is on the following page*
Question 4 Solve the following optimization problem graphically (*Cleary indicate the feasible set by shading it.*)

\[
\min_{x_1, x_2} \quad x_1 + 2x_2 \quad \text{s.t} \quad (1) \quad 2x_1 + x_2 \geq 20 \quad (2) \quad x_1 + 4x_2 \geq 24; \quad (3) \quad x_1 + x_2 \geq 15; \quad (4) \quad x_1 \geq 0, \quad (5) \quad x_2 \geq 0.
\]

The solution is \( x_1 = \quad x_2 = \) 12 points
Question 5  A consumer’s utility function is given by \( u(x_1, x_2) = \min\{5x_1, 2x_2\} \). Assume that prices are \( p_1 = 1, p_2 = 2 \) and income is \( I = 36 \).

(a) Graph the budget line in the grid below.  
(b) Graph at least three indifference curves.  
(c) Graphically solve for the optimal consumption choice.  

\[
\text{At the optimal choice } x_1 = \quad x_2 =
\]
Question 6  Suppose that demand for a product is \( Q_D(P) = 120 - 4P \). Supply is given by \( Q_S(P) = 20 + P \). Then

| The price elasticity of supply at \( P = 10 \) is \( \epsilon^S_P = \) |
| Demand is unit elastic, i.e., \( \epsilon^D_P = -1 \), at \( P = \) |

The equilibrium price and quantities are

| \( P^* = \) | \( Q^* = \) | 12 points |
Question 7

(a) Suppose that a country eliminates a tariff on imported steel. Sketch demand and supply curve that indicate what may happen as a result, in the grid below, and briefly describe the impact of the tariff in the box below:  

(b) The impact on the domestic (i.e., the country’s) automobile industry is:  

Sketch the corresponding demand-supply diagram below
**Question 8** The demand function for tickets for a sporting event is given by \( Q_D(P) = 150,000 - 100P \). Suppose there are 50,000 seats (this is the supply).

(a) Suppose tickets are sold at a price of \( P = 200 \). Then what is the excess demand for tickets (i.e., how many people would like to get a ticket at a price of 100, but are unable to get one.  

Excess demand is

(b) Suppose that you are able to get a ticket for 200 Dollars because of good connections. However, you are not interested in the event, but rather choose to sell the ticket on the secondary market (e.g, eBay). Then

Your expected profit (revenue - cost) is

**Question 9** For which of the following optimization problem should you check the box “assume linear model.” Mark the problems by circling the label below.

(a) \( \max_{x_1, x_2} 2x_1 + x_2 \text{ s.t. } x_1x_2 \geq 4, x_1 \geq 0, x_2 \geq 0; \)
(b) \( \max_{x_1, x_2} 2x_1 + x_2 \text{ s.t. } 2x_1 + x_2 \geq 4x_1 - 10x_2, x_1 \geq 0, x_2 \geq 0; \)
(c) \( \max_{x_1, x_2} 10x_1 + x_2 \text{ s.t. } x_1 - 10x_2 \geq x_2, x_1 \geq 0, x_2 \geq 0; \)
(d) \( \max_{x_1, x_2} x_1x_2 \text{ s.t. } x_1 + x_2 \geq 0, x_1 \geq 0, x_2 \geq 0; \)

Suppose the solution to an optimization problem is \( (4, 2) \). Constraints are (1) \( x_1 + 4x_2 \leq 18 \), (2) \( x_1 - 4x_2 \leq 0 \), (3) \( 2x_1 + 2x_2 \leq 12 \), (4) \( 2x_2 - x_1 \geq 0 \).

List all constraints that are slack: