Consumers (households) want to maximize their satisfaction (utility). They want to get the most utility they can -- given their income and the prices of the things they want to consume. Consumers dispose of all of their income on goods and services and savings. Savings pose no problem since savings have utility.

Let: \( Y = \text{Income} \)
\( X_1, X_2, X_3, \ldots, X_n = \text{the different goods and services purchased} \)
\( S = \text{savings} \)
\( P_1, P_2, P_3, \ldots, P_n = \text{the price of the different goods and services} \)

Thus \( Y = (P_1 \cdot X_1) + (P_2 \cdot X_2) + (P_3 \cdot X_3) + \ldots + (P_n X_n) + (S) \)

The general principle for maximization of total consumer satisfaction is that with his given income the consumer should buy those quantities of different goods and services at which the marginal utility per dollar's worth of any one is equal to the marginal utility per dollar's worth of each of the others.

This is known as the equimarginal (or equal marginal principle) and can be represented mathematically.

Let: \( MU_{X1}, MU_{X2}, MU_{X3}, \ldots, MU_{Xn}, MU_{Us} \) be the Marginal Utility gained from the purchase of the last unit of the good or service under consideration.

**Equimarginal Principle mathematically stated:**

\[
\frac{MU_{X1}}{P_1} = \frac{MU_{X2}}{P_2} = \frac{MU_{X3}}{P_3} = \ldots = \frac{MU_{Xn}}{P_n} = \frac{MU_{Us}}{S1}
\]

The equimarginal principles can be extended to as many goods as confront the consumer and is not limited to the two commodities of the example which follows.

<table>
<thead>
<tr>
<th>PRODUCT X1</th>
<th>PRODUCT X2</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUANTITY (bu.)</td>
<td>MU(_{X1}) (units of utility)</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>44</td>
</tr>
<tr>
<td>3</td>
<td>38</td>
</tr>
<tr>
<td>4</td>
<td>32</td>
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<td>5</td>
<td>26</td>
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<td>6</td>
<td>20</td>
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<tr>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

The price of \( X_1 = $2 \), of \( X_2 = $1 \). Income = $15.
1a. What combination of X1 and X2 maximizes the consumers satisfaction?

b. What is the total satisfaction gained from buying this combination of goods?

c. Reduce the purchase of X2 by $2 and buy one more unit of X1 with it. 
   What is the total utility now?

d. Refer to 1c, is total utility higher or lower than the answer in 1b?

e. Referring to 1c, does MUX1/$2 = MUX2/$1 ? 
   If not, which product has the highest MU per $?

2. Plot the above information from 1a. on the following graphs:

3a. What combination of X1 and X2 would be purchased if the price of X1 dropped to $1 and
   the price of X2 remained at $1?

   b. Plot this information on the above graphs. Connect the two points on the graph of X1. This
      is the demand curve for X1 with everything else unchanged (i.e., the price of the other good,
      income, and tastes unchanged).

   c. Do not connect the two points on the graph for X2.

4a. What combination of X1 and X2 would be purchased if the price of X2 went up to $2 and
   price of X1 remained at $1?

   b. Plot this information on the above graphs. Connect the point you plotted for X2 in
      question 3b. to the point you have just plotted for this question. This is the demand curve for
      X2 when the price of X1 is $1 and everything else is unchanged.

5a. What combination of X1 and X2 would be purchased if the price of X1 went back up to $2
   while the price of X2 remained at $2? 
   (Hint: You may buy fractions of a unit of X1 or X2 to make sure all income has been spent.)

   b. Plot this information on the above graphs. Show the demand curve for X1 when price of
      X2 remains unchanged at $2. Also, show the demand curve for X2 when the price of X1
      remains unchanged at $2.