

Economics 251
Homework #2
Due Friday May 25
20 points

Name: _____

These exercises demonstrate the ideas from the utility theory lecture on May 22 and May 23.

1. Suppose that a consumer has an income of $M = 120$, and that several indifference curves from her preferences over two commodities are shown in the top figure on page 3. Assume also that the price of commodity Y is fixed at $p_y = 4$.

Follow the instructions in steps (a) and (b) to fill in the left table below. Use the information in the table to answer question (c). Then follow the instructions in part (d) to fill in the table on the right.

p_x	$D_x(p_x)$	$D_y(p_x)$
2		
4		
6		
8		

p_x	$D_x(p_x)$	$D_y(p_x)$
2		
4		
6		
8		

(a) (1 point) Plot the budget line that corresponds to a price of X of $p_x = 2$ and determine the quantity of X consumed as well as the quantity of Y consumed. Enter the amount of X chosen for price $p_x = 2$ in the column labeled $D_x(p_x)$ in the row labeled 2. Enter the amount of Y chosen for price $p_x = 2$ in the column labeled $D_y(p_x)$ in the row labeled 2. Also, plot the price of X and the corresponding quantity of X consumed in the lower graph on page 3.

(b) (1 point) Repeat part (a) for a price of X of $p_x = 4$. Then repeat two more times with prices $p_x = 6$, and $p_x = 8$.

(c) (1 point) Are commodities X and Y complements or substitutes? Explain your answer.

(d) (1 point) The demand function for this consumer for good X is

$$D_x(p_x) = \frac{480}{p_x \cdot (p_x + 4)}.$$

The demand for good Y as a function of the price of X for this consumer is

$$D_y(p_x) = \frac{120 \cdot p_x}{4 \cdot (p_x + 4)}.$$

By entering the four different prices for X ($p_x = 2$, $p_x = 4$, $p_x = 6$, and $p_x = 8$) into these demand functions, fill in the right hand table on the previous page. Show your calculation for each of the eight cells in the table. Compare the results of the two tables.

(e) (1 point) Verify that at the chosen points, the budget equation is satisfied. That is, verify that $p_x x + p_y y = M$ when $x = D_x(p_x)$ and $y = D_y(p_x)$.

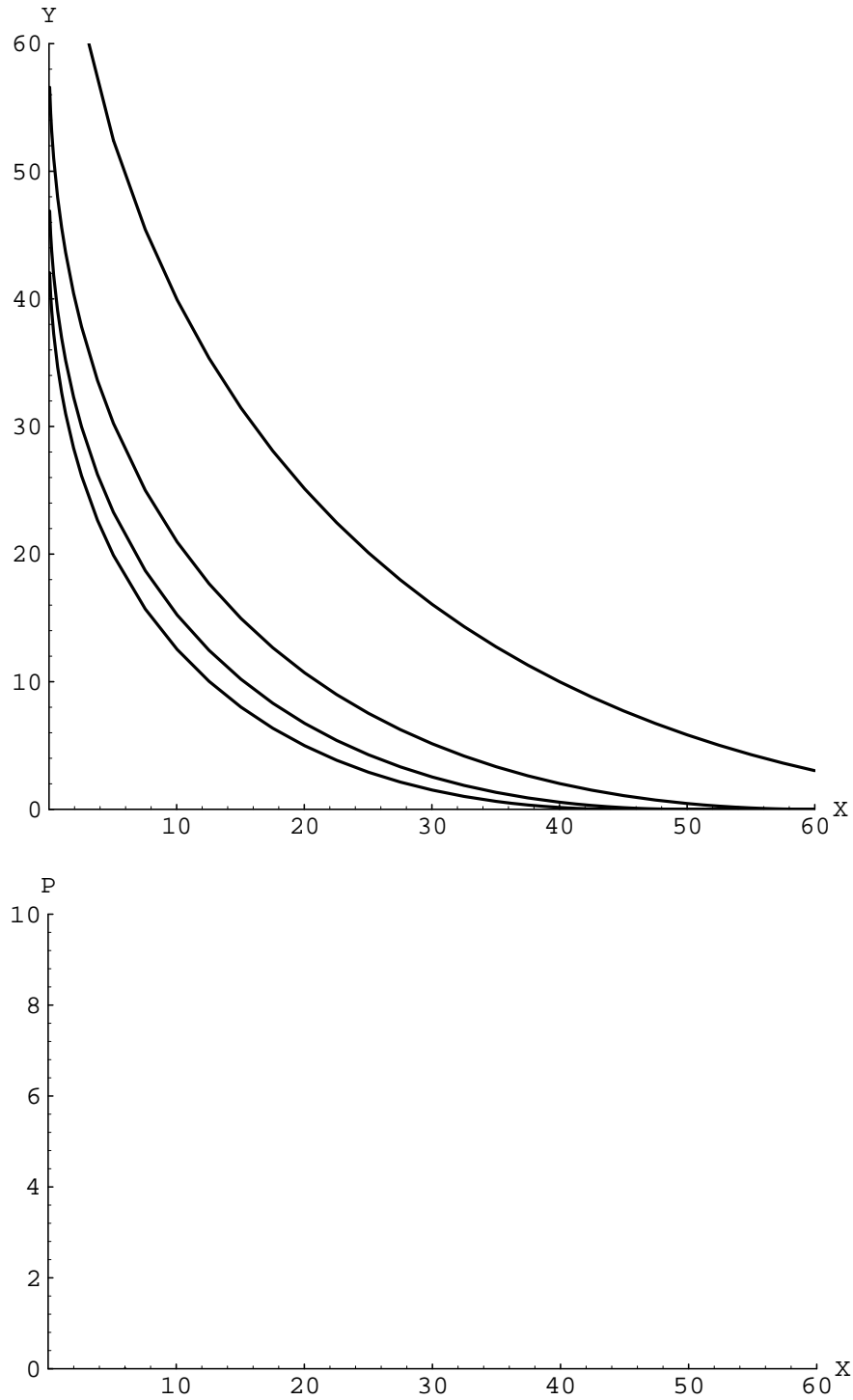


Figure 1: Graph the four budget sets for the prices and incomes given. Use the price associated with the budget set and the corresponding choice point to plot a point on the demand curve in the lower graph.

Problem 2 is the same as problem 1, except that the indifference curves in this problem come from a different utility function.

2. Suppose that a consumer has an income of $M = 120$, and that several indifference curves from his preferences over two commodities are shown in the top figure on page 6. Assume also that the price of commodity Y is fixed at $p_y = 4$.

Follow the instructions in steps (a) and (b) to fill in the left table below. Use the information in the table to answer question (c). Then follow the instructions in part (d) to fill in the table on the right.

p_x	$D_x(p_x)$	$D_y(p_x)$
2		
4		
6		
8		

p_x	$D_x(p_x)$	$D_y(p_x)$
2		
4		
6		
8		

(a) (1 point) Plot the budget line that corresponds to $p_x = 2$ and determine the quantity of X consumed as well as the quantity of Y consumed. Enter your answers in the table. Also, plot the price of X and the corresponding quantity of X consumed in the lower graph on the next page.

(b) (1 point) Repeat part (a) for a price of X of $p_x = 4$. Then repeat two more times with prices $p_x = 6$, and $p_x = 8$.

(c) (1 point) Are commodities X and Y complements or substitutes? Explain your answer.

(d) (1 point) The demand function for this consumer for good X is

$$D_x(p_x) = \frac{120}{p_x + 2 \cdot p_x^{1/2}}.$$

The demand for good Y as a function of the price of X for this consumer is

$$D_y(p_x) = \frac{120}{4 + 2 \cdot p_x^{1/2}}.$$

Use these demand functions to fill in the right hand table above.

(e) (1 point) Verify that at the chosen points, the budget equation is satisfied. That is, verify that $p_x x + p_y y = M$ when $x = D_x(p_x)$ and $y = D_y(p_x)$.

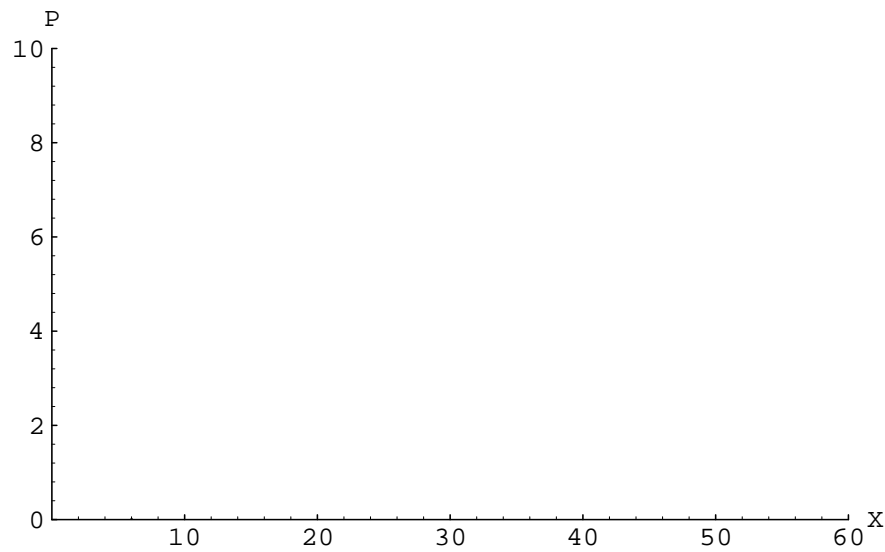
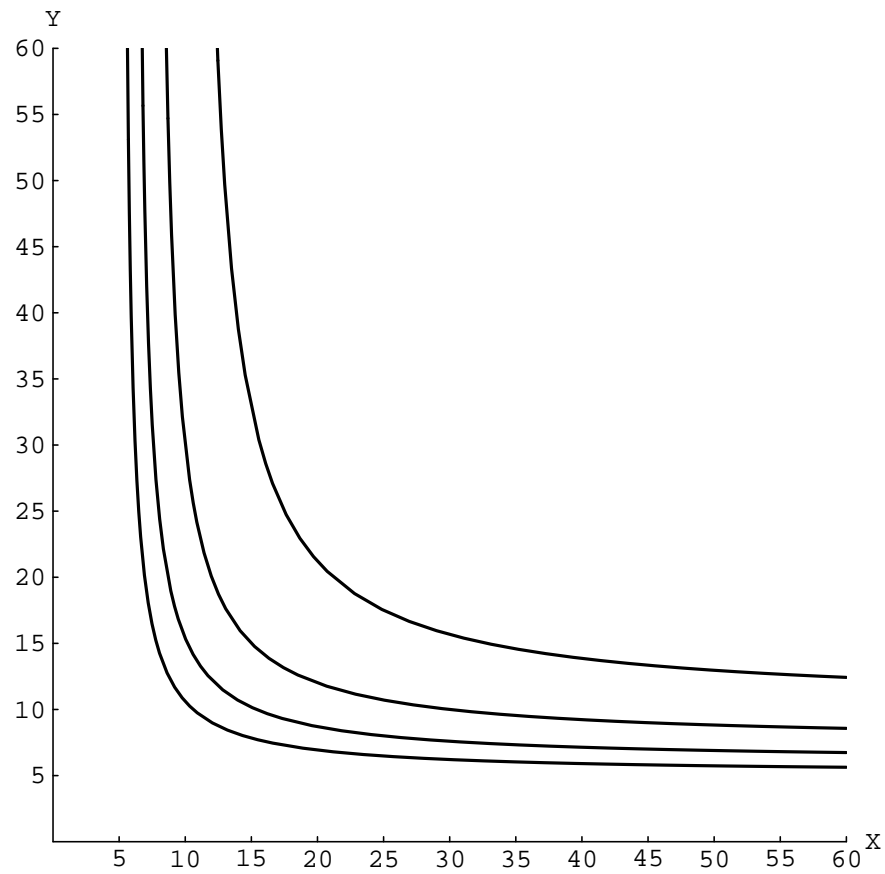


Figure 2: Graph the four budget sets for the prices and incomes given. Use the price associated with the budget set and the corresponding choice point to plot a point on the demand curve in the lower graph.

3. Suppose that a consumer has an income of $M = 120$, and that several indifference curves from his preferences over two commodities are shown in the top figure on page 9. Assume also that the price of commodity Y is fixed at $p_y = 4$.

Follow the instructions in steps (a) and (b) to fill in the left table below. Use the information in the table to answer question (c). Then follow the instructions in part (d) to fill in the table on the right.

p_x	$D_x(p_x)$	$D_y(p_x)$
2		
4		
6		
8		

p_x	$D_x(p_x)$	$D_y(p_x)$
2		
4		
6		
8		

(a) (1 point) Plot the budget line that corresponds to a price of X of $p_x = 2$ and determine the quantity of X consumed as well as the quantity of Y consumed. Enter your answers in the table. Also, plot the price of X and the corresponding quantity of X consumed in the lower graph on the next page.

(b) (1 point) Repeat part (a) for a price of X of $p_x = 4$. Then repeat two more times with prices $p_x = 6$, and $p_x = 8$.

(c) (1 point) Are commodities X and Y complements or substitutes? Explain your answer.

(d) (1 point) The demand function for this consumer for good X is

$$D_x(p_x) = \frac{60}{p_x}.$$

The demand for good Y as a function of the price of X for this consumer is

$$D_y(p_x) = 15.$$

Use these demand functions to fill in the right hand table above.

(e) (1 point) Verify that at the chosen points, the budget equation is satisfied. That is, verify that $p_x x + p_y y = M$ when $x = D_x(p_x)$ and $y = D_y(p_x)$.

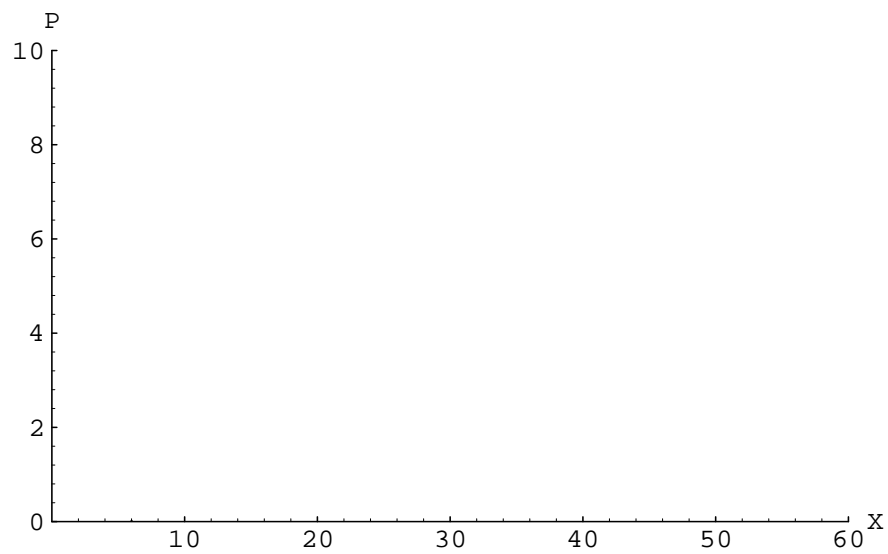
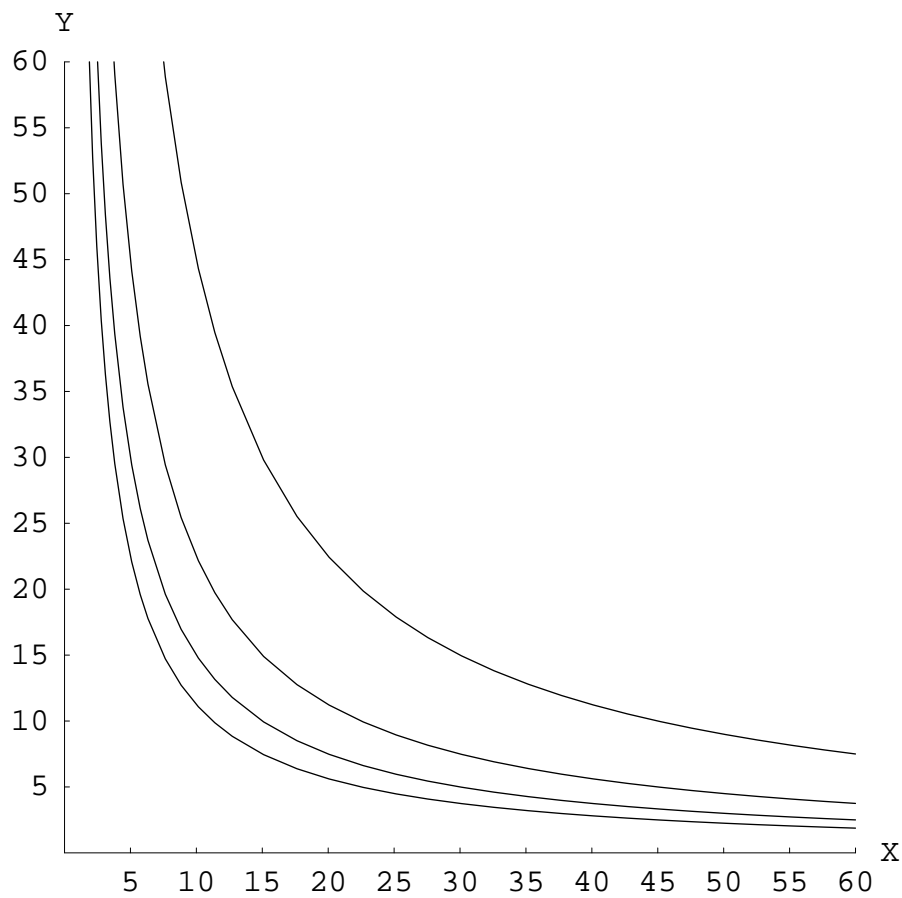


Figure 3: Graph the four budget sets for the prices and incomes given. Use the price associated with the budget set and the corresponding choice point to plot a point on the demand curve in the lower graph.

4. Suppose that a consumer has an income of $M = 120$, and that several indifference curves from her preferences over two commodities are shown in the top figure on page 12. Assume also that the price of commodity Y is fixed at $p_y = 4$.

Follow the instructions in steps (a) and (b) to fill in the left table below. Use the information in the table to answer question (c). Then follow the instructions in part (d) to fill in the table on the right.

p_x	$D_x(p_x)$	$D_y(p_x)$
2		
4		
6		
8		

p_x	$D_x(p_x)$	$D_y(p_x)$
2		
4		
6		
8		

(a) (1 point) Plot the budget line that corresponds to a price of X of $p_x = 2$ and determine the quantity of X consumed as well as the quantity of Y consumed. (Since these indifference curves are so flat, you'll need to draw the budget lines carefully to get find the tangency.) Enter your answers in the table. Also, plot the price of X and the corresponding quantity of X consumed in the lower graph on the next page.

(b) (1 point) Repeat part (a) for a price of X of $p_x = 4$. Then repeat two more times with prices $p_x = 6$, and $p_x = 8$.

(c) (1 point) Are commodities X and Y complements or substitutes? Explain your answer.

(d) (1 point) The demand function for this consumer for good X is

$$D_x(p_x) = 45 - 5p_x.$$

The demand for good Y as a function of the price of X for this consumer is

$$D_y(p_x) = (120 - 45p_x + 5p_x^2)/4.$$

Use these demand functions to fill in the right hand table above.

(e) (1 point) Verify that at the chosen points, the budget equation is satisfied. That is, verify that $p_x x + p_y y = M$ when $x = D_x(p_x)$ and $y = D_y(p_x)$.

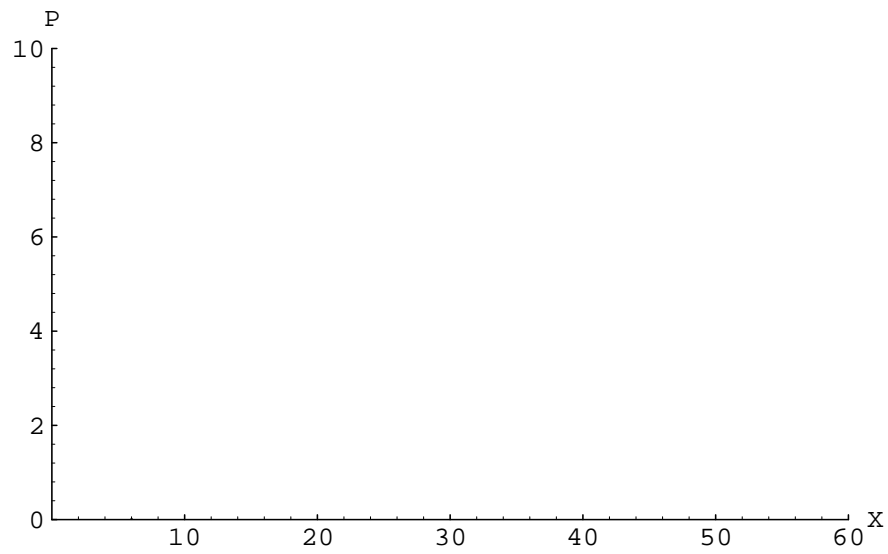
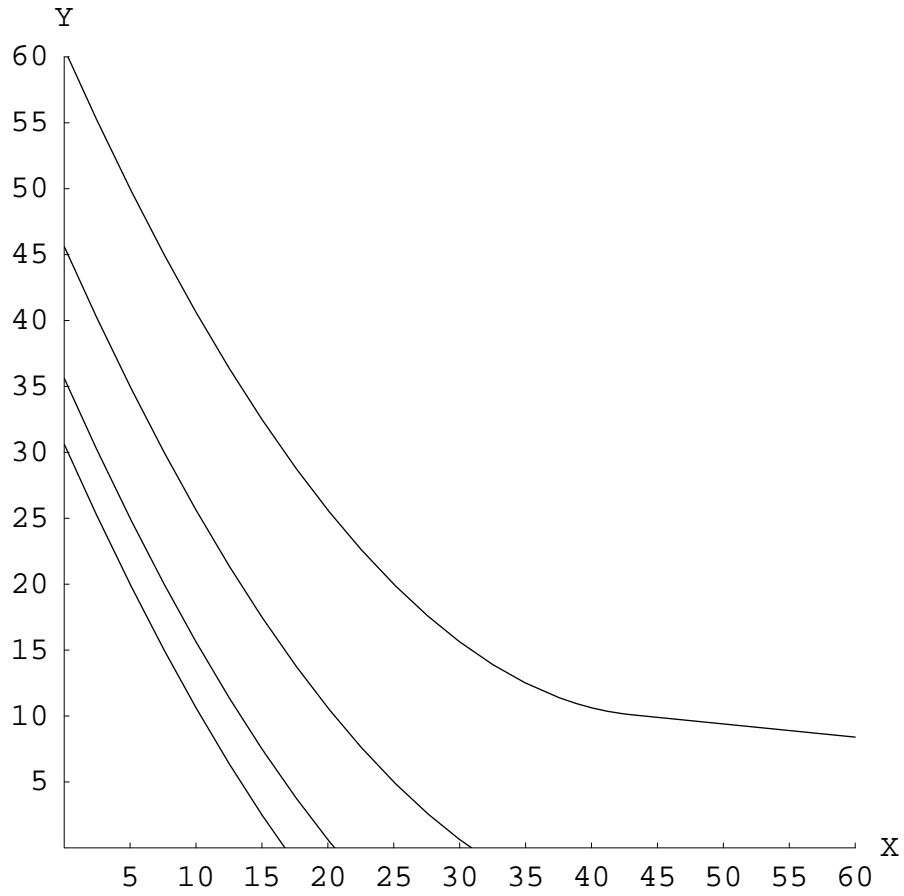


Figure 4: Graph the four budget sets for the prices and incomes given. Use the price associated with the budget set and the corresponding choice point to plot a point on the demand curve in the lower graph.