

## Economics 251

### Practice exam for exam # 2

In problems 1 and 2 use figures 1 and 2 to find two different demand functions for good  $X$ . The income level, the price of good  $Y$ , and the prices of  $X$  that you will use are given in each problem. Note that prices and income are different for each of the graphs.

1. (12 points) The top graph in figure 1 shows four indifference curves for a consumer. Suppose that this consumer has an income of  $M = 60$ , and that the price of  $Y$  is  $p_y = 2$ . On the top graph, show the budget lines for this consumer when  $p_x = 4$ , when  $p_x = 3$ , when  $p_x = 2$ , and when  $p_x = 1$ . Show the optimal consumption point for each of these four prices of  $X$ . On the lower graph, draw the demand function  $D_x(p_x; 2, 60)$  by plotting the consumption of good  $X$  for each of the four prices of  $X$ .

2. (12 points) Figure 2 is similar to figure 1. Follow the same steps as in problem 1 to graph the demand function for good  $X$  when the income is  $M = 60$  and the price of  $Y$  is  $p_y = 5$ . On the top graph, show the budget lines for this consumer when  $p_x = 10$ , when  $p_x = 6$ , when  $p_x = 5$ , and when  $p_x = 3$ . Show the optimal consumption point for each of these four prices of  $X$ . On the lower graph, draw the demand function  $D_x(p_x; 5, 60)$  by plotting the consumption of good  $X$  for each of the four prices of  $X$ .

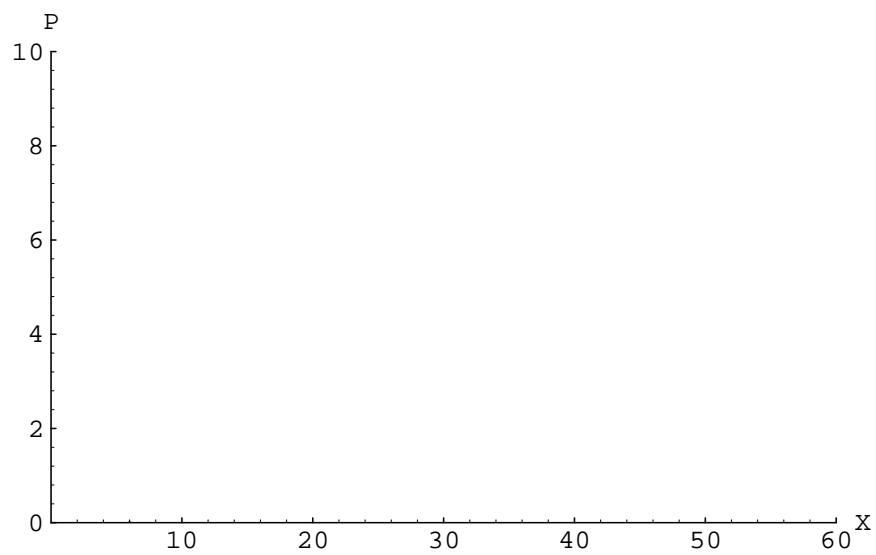
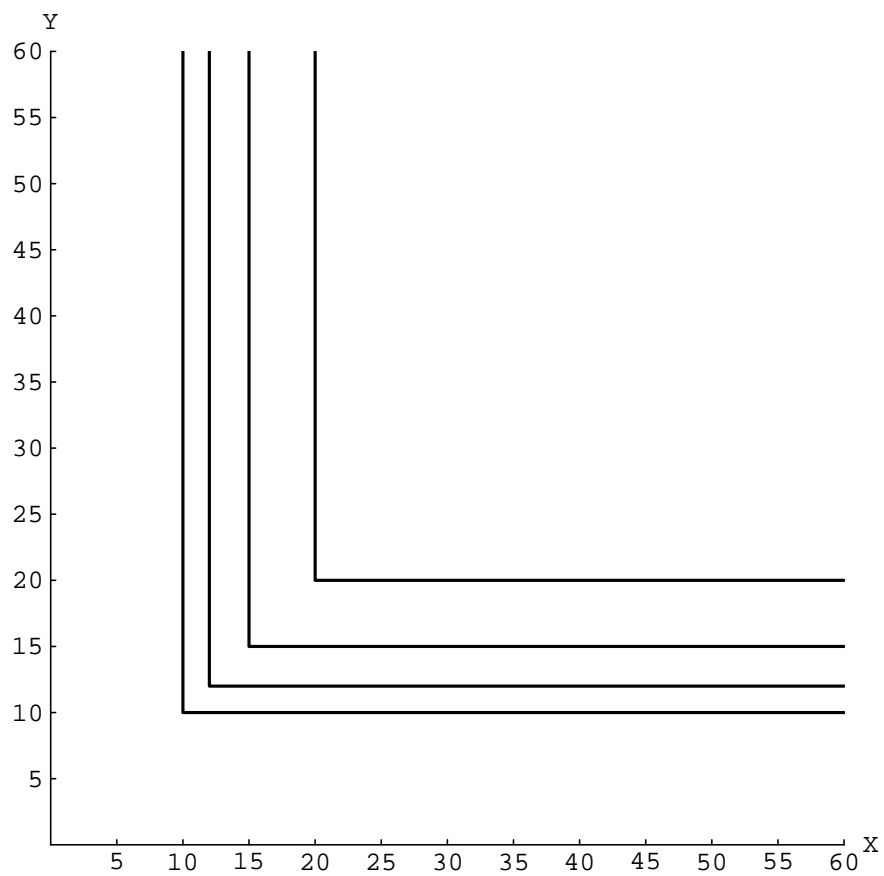


Figure 1: By graphing the four budget sets for the prices and incomes given in problem 1, use the indifference curves shown in the top graph to draw the demand curve in the lower graph.

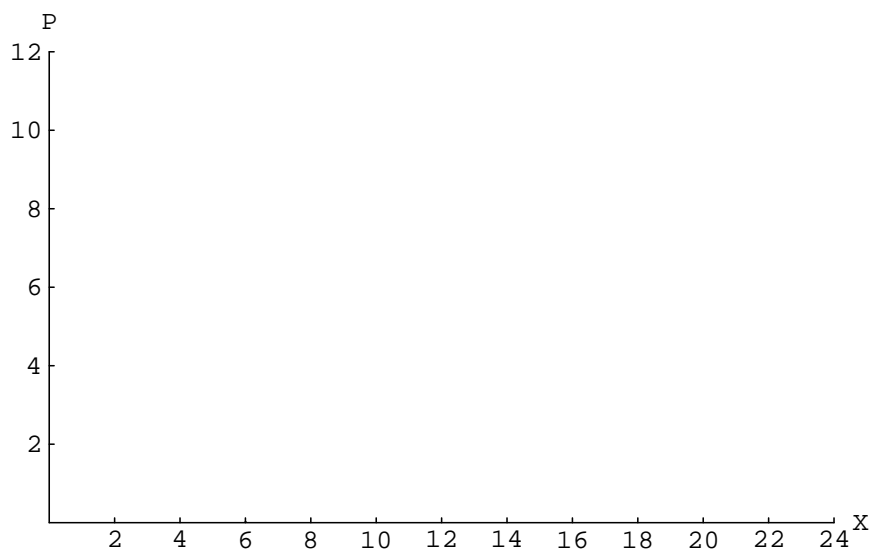
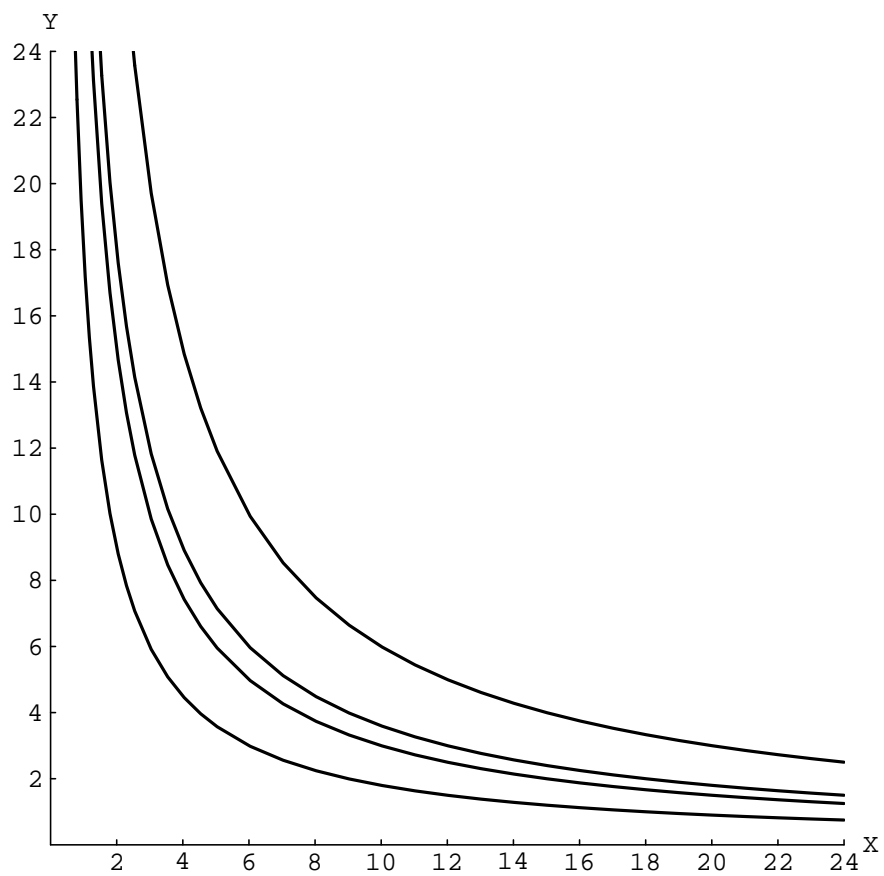


Figure 2: By graphing the four budget sets for the prices and incomes given in problem 2, use the indifference curves shown in the top graph to draw this consumer's demand curve in the lower graph.

3. (10 points) The demand functions in parts (a) and (b) of this problem correspond to one of the sets indifference curves shown in the top half of figures 1 and 2. Determine the matching between these demand functions and the indifference curves. Explain your answer by showing to which optimal choices (in figure 1 or 2) each demand function corresponds. Remember that the prices and income used in each of the two graphs were different, so you also need to substitute the correct set of prices and income in each pair of equations below.

For example, the price of  $Y$  and the income in figure 1 were  $p_y = 2$  and  $M = 60$ . The prices of  $X$  were  $p_x = 1, p_x = 2, p_x = 3,$  and  $p_x = 4$ . If these values of  $p_x, p_y,$  and  $M$  are substituted into equations (1) and (2), are the resulting quantities demanded the same as those found in figure 1? If so, then figure 1 corresponds to equations (1) and (2).

- (a) Fill in table 1 using the demand function

$$D_x(p_x, p_y, M) = \frac{M}{2 \cdot p_x} \tag{1}$$

for good  $X$  and the demand function

$$D_y(p_x, p_y, M) = \frac{M}{2 \cdot p_y} \tag{2}$$

for good  $Y$ . When filling in the table, use the prices and income from either problem 1 or problem 2 above so that the quantities of  $X$  and of  $Y$  demanded are the same as those found in the corresponding figure. Which figure do these demand functions correspond to?

$p_x$	$p_y$	$M$	$D_x(p_x, p_y, M)$	$D_y(p_x, p_y, M)$

Table 1: Fill out the table above with values from the demand equations (1) and (2). Choose the values of  $p_x, p_y,$  and  $M$  from one of the two problems above so that the quantities demanded that you find correspond to the optimal choice in either figure 1 or figure 2.

(b) Fill in table 3 using the demand functions

$$D_x(p_x, p_y, M) = \frac{M}{p_x + p_y} \tag{3}$$

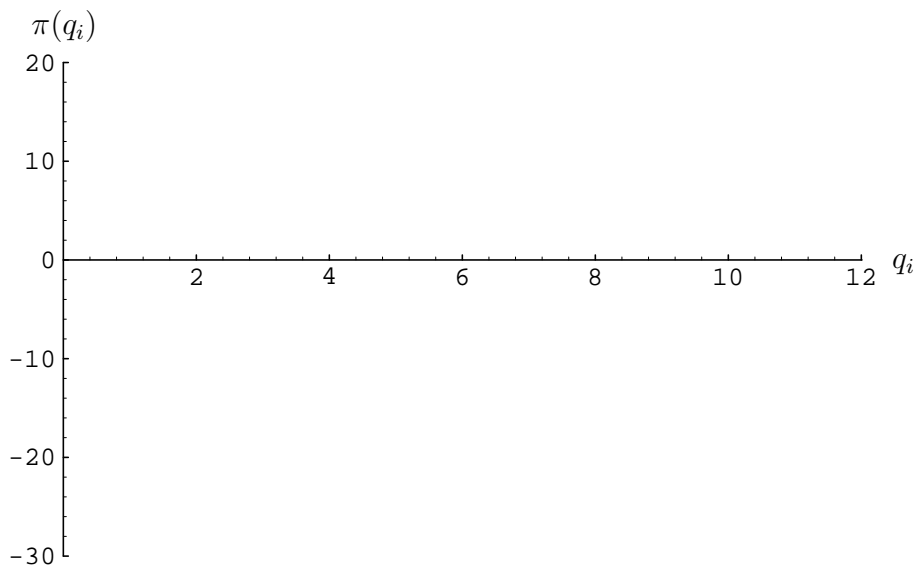
$$D_y(p_x, p_y, M) = \frac{M}{p_x + p_y}. \tag{4}$$

$p_x$	$p_y$	M	$D_x(p_x, p_y, M)$	$D_y(p_x, p_y, M)$

Table 2: Fill out the table above with values from the demand equations (3) and (4) following the procedure described in the problem and in the table 1 caption.

4. (36 points) Suppose there is an industry with market demand  $D(p) = 50 \cdot (24 - p)$ , and 100 firms, each with the cost function  $C_i(q_i) = q_i^2 + 25$ . Take the marginal cost function for each firm as  $MC_i(q_i) = 2q_i$ .

- (a) (6 points) Write down the profit function  $\pi_i(q_i)$  for a typical firm in this market. Assume that the market is competitive so that the revenue function for the firm is  $R_i(q_i) = p \cdot q_i$ . Suppose that each firm initially faces a market price  $p^* = 12$ . Graph the profit function for a typical firm for this price.



- (b) (6 points) Use the profit maximization condition  $p = MC(q)$  to find the profit maximizing output  $q_i^* = S^i(p)$  for each price  $p$ . Check that your answer is consistent with the profit maximizing output at  $p = 12$  in part (a). Graph the firm's supply function on the left side of figure 3.

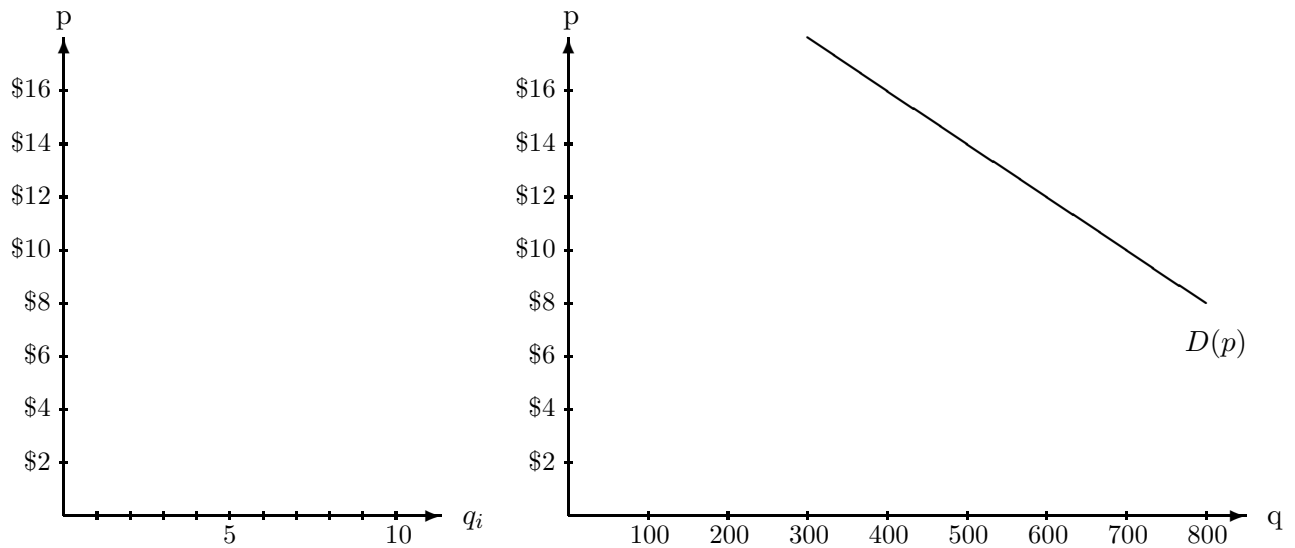


Figure 3: Use the diagram on the left to graph  $AC_i(q_i)$  and  $S^i(p)$  for a typical firm in the market. Use the diagram on the right to graph the market supply  $S(p)$  and to find the equilibrium price  $p^*$ .

(c) (6 points) Find the average cost function for a typical firm in this market. Graph the average cost function on the left diagram in figure 3.

(d) (6 points) Write down the market supply by noting that the market supply is  $q = S(p) = N \cdot S_i(p)$ , where  $N$  is the number of firms in the market. Graph the market supply on the right side of figure 3.

(e) (6 points) What is the equilibrium price in this market? What is the economic profit for each firm at this price? Show the economic profit for the typical firm in the diagram on the left of figure 3. Is this market in long-run equilibrium?

(f) (6 points) What is the long-run equilibrium price in this market? How many firms will there be in the market if new firms enter the market until it reaches a long-run equilibrium?