

Answer all questions, showing all your work. Try to use diagrams wherever possible. Time allowed: 1 hour and 30 minutes. Good luck! (Numbers in parentheses refer to the number of points attached to each question and suggested time allocation.)

1. (15 points, 10 minutes)
  - (a) What is an Engel curve?
  - (b) Draw in a clearly labeled diagram the Engel curve for a good which is a luxury at low levels of income and becomes a necessity at income levels above the income level  $I_1$ . Justify your chosen graph with a brief explanation.
  - (c) Draw in a clearly labeled diagram the Engel curve for a good which is a necessity at low levels of income and becomes an inferior good at income levels above the income level  $I_2$ . Justify your chosen graph with a brief explanation.

2. (25 points, 20 minutes) Lily buys only two goods,  $x$  and  $y$ . Her utility function is
 
$$U(x, y) = 2x + 3y$$
  - (a) Let  $p_y = 1$ . Find Lily's ordinary and compensated demand curves for income level  $I = 100$  and utility level  $U = 300$ .
  - (b) Draw both demand curves you found in part (a) in a single clearly labeled diagram.

3. (30 points, 30 minutes) Suppose a perfectly competitive firm has the production function

$$q(K, L) = \frac{KL}{K + L}$$

where  $K$ ,  $L$  are the quantities of capital and labor it uses. Let  $r$  and  $w$  represent the input prices.

- (a) Does the production function exhibit constant, decreasing, or increasing returns to scale? Prove your answer.
  - (b) Find the firm's long run cost function.
  - (c) Draw the firm's long run cost curve in a clearly labeled diagram.
4. (30 points, 30 minutes) The monthly demand for gadgets in the country of Small is

$$Q_d = 5,000 - 100p,$$

where  $Q_d$  is the market demand and  $p$  is the market price. The monthly domestic supply curve of gadgets is given by

$$Q_s = 150p.$$

- (a) What will be the equilibrium price of gadgets and how many will be sold each month?
  - (b) Suppose gadgets can be imported freely in any quantity at a price of \$10. What will now be the equilibrium price of gadgets, how many will be consumed, how many will be produced domestically and how many will be imported?
  - (c) Suppose the government of Small imposes a \$5 per unit import tax on gadgets. What will now be the equilibrium price of gadgets, how many will be consumed, how many will be produced domestically and how many will be imported?
  - (d) Does Small gain or lose welfare as a result of the import tax? Calculate the net welfare effect and show this in a clearly labeled diagram.