Homework

1. A firm produces both pencils and erasers in a ratio of 2:3. Its costs are:

$$C(q_1, q_2) = 3200 + 0.1q_1 + 2q_1^2 + 0.2q_2$$

   where q_1 is the output of pencils and q_2 the output of erasers. What are its ray average costs, and what scale of production minimizes these? What would the minimum efficient scale be if the firm produced only pencils? What if it produced only erasers?

2. If the market demand curve is $Q = 100 - p$, what is the market price elasticity of demand? If the supply curve of individual firms is $q = p$ and there are 50 identical firms in the market, draw the residual demand facing any one firm. What is the residual demand elasticity facing one firm at the competitive equilibrium?

3. If the demand curve is:

$$Q(p) = p^\varepsilon,$$

   what is the elasticity of demand? If MC is $1 and ε equals -2, what is the profit-maximizing price?

4. An industry consists of eleven identical firms with costs:

$$c(q) = 4q + q^2,$$

   Market demand is $Q = 100 - p$. What are the equilibrium price, output and profits of each firm if all eleven participate in a cartel? If a single firm cheated, what would its output and profits be, assuming the other firms maintain the cartel price?

5. An industry consists of two firms which can either "collude" or "compete" in each period. The per period payoffs of doing either are as follows:

		Firm 1		
Firm 2		Collude		Compete
Collude	$50	$50	-$10	$75
Compete	$75	-$10	$45	$45

   If the firms initially collude, either of them can earn $25 extra by cheating on the agreement and competing instead. The other firm can retaliate, however, by refusing to collude in subsequent periods.
   (i) For how many periods would such retaliation have to last to deter cheating if the interest rate is 0%, so that the firms do not discount future profits?
   (ii) Would this minimum retaliation period be longer if the interest rate were positive? Why or why not?
   (iii) What is the minimum retaliation period if the interest rate is 10%?
   (iv) Is there an interest rate so high that no retaliation ever deters cheating? If so, what is it?