

**Problem Set 2: due Thursday March 1, 2001, in class**  
(Late assignments will not be graded)

**Part A: Numerical Problems**

1. Consider a new durable good (or innovation). Suppose that potential consumers of the product have an adoption curve given by  $Q = 500 + 500 \cos\left(\frac{p}{157}\right)$  for  $100 < p < 500$ , where  $Q$  is number adopting the new product. This can be thought of as a demand curve except, because it is a durable good, adoption occurs once and for all (assume no un-adoption). Consider that producers behave competitively, but have decreasing costs over time. Suppose the representative producer has marginal cost as a function of quantity and time given by  $MC(Q, t) = 450 - 20t$ . Here  $t$  is time in years. In other words producers have constant marginal cost at any given point in time.
  - a) Plot the diffusion curve with % diffusion on the y axis and time on the horizontal axis for the first 20 years. Assume the maximum amount that can be sold is 1000 units when calculating % diffusion.
  - b) Suppose there is a significant positive externality to using this new technology. The government decides after the first five years of production that it wants to induce 50% by the 6<sup>th</sup> year. What policy will the government use to achieve this goal? How much will this policy cost the government in year 6? How much would it cost to maintain this goal in years 7 through 15? Plot the diffusion curve assuming they institute this policy beginning at  $t = 6$ .
2. Farmer John currently uses flood irrigation, but is considering the more efficient drip technology. His production function is given by  $Y = \sqrt{hX}$ . Where  $h$  is the efficiency of the irrigation technology,  $X$  is his water input and  $Y$  is crop yield. Suppose the price of output,  $P_Y$ , is 250, and the price of water,  $P_X$ , is 25. Suppose that flood irrigation has efficiency of  $h_f = 0.75$ , and drip has efficiency of  $h_d = 0.80$ .
  - a) Calculate water demand, output supply and profit when using flood irrigation.
  - b) Calculate water demand, output supply and profit when using drip irrigation.
  - c) Under which technology is more water used? Under which technology is more water wasted?
  - d) What is the maximum price John will pay to switch to drip irrigation? How does this depend on the price of water (and hence any water subsidy)?

**Part B: Essay question**

As many of you are aware, states have varying restrictions on automobile emissions. In Utah, restrictions vary according to where you live. There are virtually no restrictions in the southeast desert. On the other hand cars in Salt Lake must meet very strict emissions standards. Within many states restrictions vary based on technology. SUVs and older cars may have very few restrictions, but newer cars and smaller cars will be heavily monitored. Why might these governments want to set these differing standards? What effect will these different standards have on adoption of technology? What solution might Coase suggest?