

Problem Set 1

Note that all problem sets include both problems to turn in and review problems. Look over the review problems before working on the problem sets, because often they contain material showing you how to do the problems.

1. *psquared*. Suppose the demand function for a good is $q = 100 - 2p^2$.
 - (a) Find the first and second derivatives of this demand function. What are the signs of the derivatives?
 - (b) Graph this demand function. Explain how your answer to part (a) affects the shape of the curve.
 - (c) Find an expression for the price elasticity of demand.
2. *SUVs*. This question asks you to analyze the market for Sport Utility Vehicles (SUVs).
 - (a) The demand function (measured in hundreds of thousands of vehicles) for SUVs turns out to be $q^d = 4027p^{-1.5}$, where p is the price of a typical SUV (in this problem we will measure price in tens of thousands of dollars). What are the first and second derivatives of this function? Graph the function and explain how the first and second derivatives relate to the shape of the graph.
 - (b) The supply of SUVs turns out to be $q^s = 258.3p$. What is the equilibrium price and quantity?

- (c) Suppose that the price of gas rises. Which of the following is more likely to be the new demand curve for SUVs? Why?

$$q^d = 4300p^{-1.5} \quad q^d = 3700p^{-1.5}$$

- (d) Calculate and graph what happens to the equilibrium price and quantity after the demand curve changes.

3. *Healthcare.* Recently in my e-mail, I received notice of a new article published in an economics journal. The article is entitled “A theoretical rationale for an inelastic demand for health care.”
- (a) OK, you've only taken a few days' worth of economics, but can you provide a theoretical rationale for inelastic demand for health care?
- (b) Draw a supply and demand diagram for health care making both functions linear. Draw the diagram so that at the equilibrium, demand is inelastic and supply is perfectly elastic.
- (c) If costs rose in the health care industry, show what would happen in your diagram, and discuss the relative size of the changes in the quantity and price of health care.
4. *Accord.* The elasticity of demand for Honda Accords is -4.798 (really!). Suppose the base price of an Accord is \$17,445 (LX 2 door with manual transmission). Suppose a Honda dealer sells 40 Accords per month.
- (a) Find a linear demand curve for Honda Accords at this dealership.
- (b) What is the change in revenue if the dealer offers a \$500 incentive discount?
- (c) Why do you think the elasticity is so high?

Review Problems only, not to turn in:

5. According to Jerry Muller's book *The Mind and the Market*, what were the two traditions in Western thought that made commerce and money-lending disreputable occupations?
6. *Shifters*. Illustrate and explain the impact on equilibrium market price and quantity exchanged of each of the following changes:
 - (a) An improvement in the technology of production
 - (b) An increase in individuals' desire for the good
 - (c) An decrease in the wage paid to all workers (be careful on this one)
7. Identify the following as positive or normative statements:
 - (a) "Hard bop" jazz music causes warts and hearing loss.
 - (b) Free jazz music is an unparalleled musical experience.
 - (c) The U.S. unemployment rate is lower than at this time last year.
 - (d) The U.S. unemployment rate is still too high.
 - (e) Unemployment in teenage labor markets would go up if the minimum wage were raised.
 - (f) The government should raise the minimum wage.
8. *Axolotls*. Suppose the market demand for axolotls, is given by the function $x = \frac{A}{p_x}$, where x denotes quantity demanded, p_x is the market price of axolotls, and A is a constant.
 - (a) Graph this demand function.
 - (b) Using calculus, derive an expression for the price elasticity of demand as a function of the p_x . How does elasticity vary with the price?

- (c) For any given point on the demand function, determine the impact of changing price on consumers' total expenditure on this good.
- (d) Now suppose the demand function were instead given by $\frac{A}{p_x + p_y}$, where p_y is the price of some good other than axolotls. Are goods x and y substitutes or complements? Explain.

Answers to Review Problems:

5. The first tradition is the *civic* tradition, alternatively the *civic republican* or *classical* tradition. Going back to Aristotle, it says that a citizen's proper focus is the *polis* or state. The state is best served by citizens engaged in public affairs and managing their estates for agriculture. Commerce and labor are distasteful and should be left to foreigners and slaves.

The second tradition is the *Christian* tradition which is based on Biblical passages including Gospel accounts of Jesus' sayings and actions. These regard commerce and especially money-lending as immoral. They are based on zero-sum thinking that if one person gets richer, it necessarily means someone else gets poorer. Later Christian thinkers drew on Aristotle's notions of natural and unnatural uses of goods to bolster this tradition.

The two traditions were combined to force Jews into the money-lending role in the late Middle Ages, since Jews could be classified as both foreigners and non-Christians.

6. *Shifters_a.*

- (a) Technology affects only supply. An improvement means a greater quantity supplied at any given price, hence a right shift of the supply curve. Market equilibrium price falls and quantity rises.

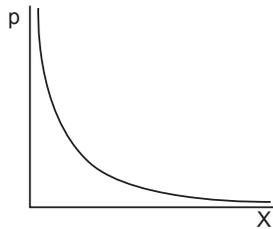
- (b) “Desire” reflects tastes, which affect the demand curve. Increased desire means a higher quantity demanded at any given price, hence a right shift of the demand curve. Market equilibrium price rises and quantity rises.
- (c) Since wages of *all* workers fall, we can expect two effects. First, for any particular good, demand will shift to the left because of lower incomes (assuming the good is a normal good). Second, the lower wage is a lower cost to firms, so supply will shift to the right. The market equilibrium price will definitely fall, but the effect on quantity exchanged is indeterminate.

This type of problem is important in macroeconomics, and we will build a more complete model of this situation later in the course.

- 7. (a) P
- (b) N
- (c) P
- (d) N or P, depending on interpretation of “too high:” “too high to achieve positive condition X” or “undesirably high.”
- (e) P
- (f) N

8. *Axolotls.*

- (a) The graph is:



(b)

$$\begin{aligned}\epsilon &= \frac{dx}{dp} \frac{p_x}{x} \\ &= -\frac{A}{p_x^2} \frac{p_x}{p_x} \\ &= -1\end{aligned}$$

This is an example of a *constant elasticity demand function* along which elasticity does not vary with price. In this case, it's unit elastic along the entire curve.

- (c) On this curve, total expenditure is $p_x x = p_x \frac{A}{p_x} = A$. Thus total expenditure on the good is A regardless of the price. This makes sense since the curve is unit elastic: total spending/revenue does not change as price changes.
- (d) Suppose p_y increases. We find the effect on demand by taking the derivative with respect to p_y :

$$\frac{dx}{dp_y} = -\frac{A}{(p_x + p_y)^2} < 0$$

Since the derivative is negative, an increase in p_y reduces demand for x , which means the goods are complements.