

## Exam #3 (100 Points Total)

- Take the exam during an *uninterrupted period of no more than 3 hours*. (It should not take that long.) The space provided below each question should be sufficient for your answer, but you can use additional paper if needed. *You are encouraged to show your work for partial credit*. It is very difficult to give partial credit if the only thing on your page is “ $x = 3$ ”.
- *Other than this cheat sheet, all you are allowed to use for help are the basic functions on a calculator*. Partial translation: no books, no notes, no websites, no talking to other people, and no advanced calculator features like programmable functions or present value formulas.
- People who have taken the exam can talk to each other all they want, and people who have not taken the exam can talk to each other all they want, but communication between the two groups about class should be limited to three phrases: “Yes”, “No”, and “Have you taken the exam?”
- For questions or other emergencies, call me at x5124 or 206-351-5719.
- A **Pareto efficient** (or **Pareto optimal**) allocation or outcome is one in which it is not possible find a different allocation or outcome in which nobody is worse off and at least one person is better off. An allocation or outcome B is a **Pareto improvement over A** if nobody is worse off with B than with A and at least one person is better off.
- **Total revenue** is price times quantity:  $TR = pq$ .
- The **price elasticity of demand at point A** measures the percentage change in quantity demanded (relative to the quantity demanded at point A) resulting from a 1% increase in the price (relative to the price at point A). The formula is

$$\varepsilon(A) = \frac{\% \text{ change in } q}{\% \text{ change in } p} = \frac{\frac{\Delta q}{q_A}}{\frac{\Delta p}{p_A}} = \frac{\Delta q}{\Delta p} \cdot \frac{p_A}{q_A} = \frac{q_B - q_A}{p_B - p_A} \cdot \frac{p_A}{q_A}.$$

**In English** If, at point A, a small change in price causes the quantity demanded to increase by a lot, demand at point A is elastic; if quantity demanded only changes by a little then demand at point A is inelastic; and if quantity demanded changes by a proportional amount then demand at point A has unit elasticity.

**In math** If, at point A, the price elasticity of demand is less than  $-1$  (e.g.,  $-2$ ), then demand at point A is elastic; if the elasticity is greater than  $-1$  (e.g.,  $-\frac{1}{2}$ ), then demand at point A is inelastic; if the elasticity is equal to  $-1$  then demand at point A has unit elasticity.