

## 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

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

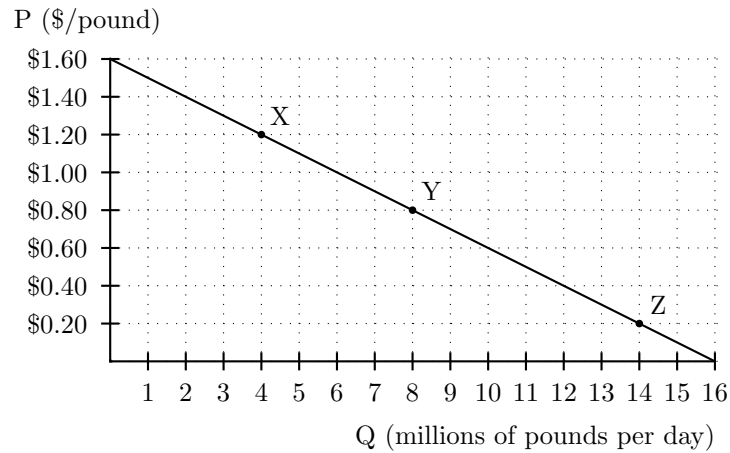
**In English** If, at point A, a small change in price causes the quantity demanded to increase by a lot, demand at point A is elastic; if quantity demanded only changes by a little then demand at point A is inelastic; and if quantity demanded changes by a proportional amount then demand at point A has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



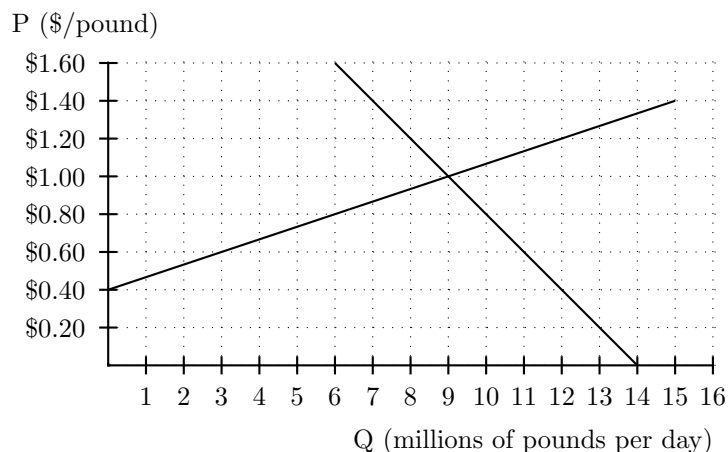


3. Below is a hypothetical demand curve for oranges.



- (a) (5 points) During normal years, the supply curve is such that point Y is the equilibrium. Of the other two points, one is the equilibrium during “bad” years (when frost damages the orange crop), and one is the equilibrium during “good” years (when the orange crop thrives). Which one is point X? Circle one: X = bad good
- (b) (5 points) What is the total revenue at point X? At point Y? At point Z? (Use correct units!)
- (c) (5 points) The orange growers’ profit is total revenue minus total costs. If total costs are the same in all years, do the growers have higher profits in “bad” years or “good” years? (Circle one.)

4. Below is a hypothetical market for oranges.

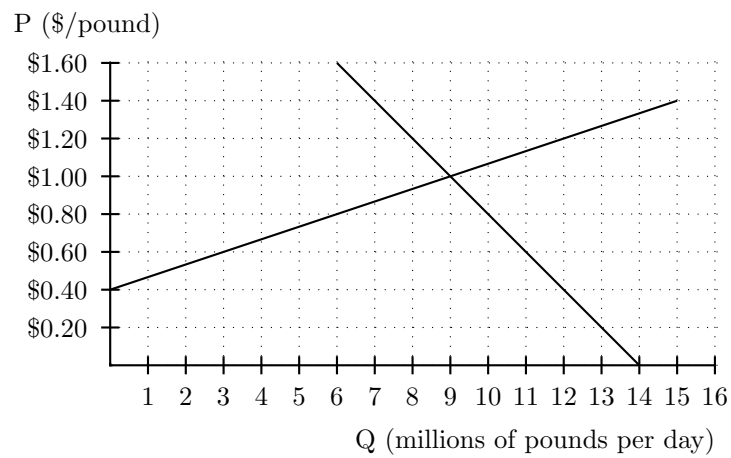


Suppose that the government decides to impose a per-unit tax of \$0.80 on the buyers of oranges.

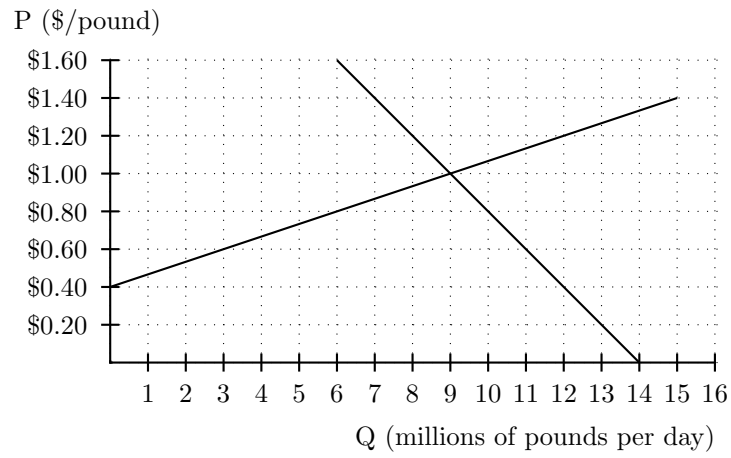
- (a) (5 points) Show the impact of this tax on the supply and demand curves above.
- (b) (5 points) Explain (as if to a non-economist) why the tax shifts the curves the way it does. Your answer here must be quantitative, i.e., must explain not only the *direction* of the curve shift(s) but also the *amount* of the curve shift(s).
- (c) (5 points) Calculate the economic incidence of the tax, i.e., the amount of the tax burden borne by the buyers ( $T_B$ ) and the amount borne by the sellers ( $T_S$ ). Then calculate their ratio  $\frac{T_B}{T_S}$ .

- (d) (5 points) Calculate the price elasticity of supply,  $\varepsilon_S$ , at the original (pre-tax) equilibrium. Then calculate the price elasticity of demand,  $\varepsilon_D$ , at the original (pre-tax) equilibrium. Then calculate their ratio,  $\frac{\varepsilon_S}{\varepsilon_D}$ . How does this ratio compare to the ratio of the tax burdens?

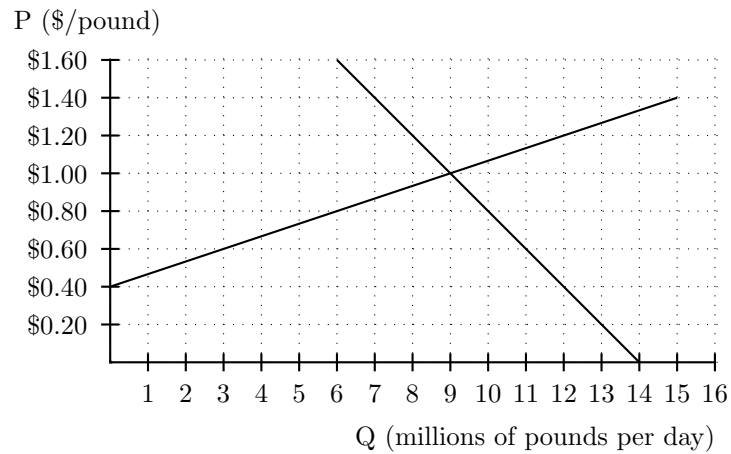
5. (5 points) Show the result if the government had instead imposed an \$.80 per-unit tax on the sellers.



6. (5 points) Show the result if the government had instead imposed a sales tax of 50% on the sellers.



7. (5 points) Show the result if the government had instead imposed a sales tax of 50% on the buyers.



8. (5 points) Consider a world with 1,000 buyers: 500 of them have an individual demand curve of  $q = 20 - 2p$ , and 500 of them have an individual demand curve of  $q = 10 - 5p$ . There are also 500 sellers, each with an individual supply curve of  $q = 6p - 10$ . Determine the market demand curve and the market supply curve. *Circle your answers!*
9. Consider a world with market demand curve  $q = 50 - 6p$  and market supply curve  $q = 20p - 28$ .
- (a) (5 points) What is the market equilibrium price and quantity? *Circle your answer!*
- (b) (5 points) How would the equations for the supply and demand curves change if the government imposed a tax of \$.50 per unit on the buyers? (Note: You do *not* need to find the new equilibrium; just write down the equations.)
- (c) (5 points) How would the equations for the supply and demand curves change if the government imposed a sales tax of 20% on the sellers? (Note: You do *not* need to find the new equilibrium; just write down the equations.)