Elasticity

1. The demand equation for a monopolist’s product is \( p = 250 - 0.2q \).
   a. Find the price-elasticity of demand (as a function of \( q \)).
   b. What is the price elasticity of demand when \( p = $50 \)? Is demand elastic, inelastic, or does demand have unit elasticity at this point?
   c. Suppose that the price is lowered (from $50) to $49.25. Use your answer to part b. to estimate† the percentage change in demand.
   d. What effect will this change in price have on the firm’s revenue? Be as precise as you can, and explain your answer.

2. The (short-run) production function for ACME Widgets is given by \( Q = 50K_0(L-10)^{2/3} \), where \( Q \) is the weekly output of widgets, \( L \) is the weekly labor input, measured in $1000s, and \( K_0 \) is the fixed level of capital input.
   a. Compute the labor-elasticity of output, \( \eta_{Q/L} \), as a function of \( L \).
   b. What is the labor-elasticity of output when labor input is $45000 a week?
   c. Suppose that ACME hires two additional widget polishers, at a combined cost of $1500 a week. Use your answer to part b. to estimate† the resulting percentage change in output.
   d. Can the answers above be used to estimate the change in ACME’s weekly revenue? If so, what is the resulting change in revenue? If not, explain why not.

3. The demand equation for the SlugWorks Calculator company is \( q = 500(p + 50)e^{-0.04p} \).
   a. Compute the price-elasticity of demand, as a function of \( p \).
   b. Find the price, \( p_0 \), where demand has unit elasticity. Round your answer to 2 decimal places.
   c. How many calculators can SlugWorks’ sell at the price you found in part b.? What will their revenue be?
   d. What will happen to their revenue if they raise the price (slightly) above \( p_0 \)? What will happen to revenue if they lower the price (slightly)? Justify your answers.

4. The supply curve for the widget market is given by \( q = 0.01p^2 + 0.4p - 2 \).
   a. Find the price-elasticity of supply when \( p_0 = 10 \).
   b. Use the approximation formula for elasticity† to estimate the percentage change in supply if the price is raised from \( p_0 = 10 \) to \( p_1 = 10.50 \).

†See the approximation formula for elasticity, SN 6.