1. Definitions (use words not equations) 3 lines or less
   • 1pt Please define Natural monopoly
     A natural monopoly occurs when the entire market can be efficiently served by a single firm because economies of scale determine that average costs are lower with one firm than with multiple firms.

2. Word problem
   • 2pts Suppose that a firm dumps wastes into a river, decimating the fish population and reducing the profits of the fishermen living along the river by $100,000 a year. The cost of eliminating the wastes for the firm is $60,000 a year. The fishermen sue the firm in court to stop the pollution. If Coase was right, does it matter what the judge decides? How? Why? Why might Coase be wrong in this case? (hint who bears the cost of litigation)
     If the firm is assigned property rights, the fishermen will pay $60,000 to the firm to eliminate the toxic waste. If, on the other hand, property rights are assigned to the fishermen, the chemical producer will clean up the waste, because this is cheaper than compensating the fishermen. Therefore, regardless of who property rights are assigned to, the toxic waste will be cleaned up because this is less costly than the damage. The cost of litigation will have to be borne by someone, and unless the fishermen can get together to bear those costs there is an additional public good problem (whom ever sues bears costs if they lose at trial) therefore no one may sue and the ‘inefficient allocation may prevail.

   • Assume that a monopolist with total cost function \( c(q) = q^2 + 50q \) faces a market demand curve given by \( q^d = 550 - P \).
     a) Obtain the optimal production level, price, and profit level for the monopolist.
        \[
        MC = MR \iff 2q + 50 = 550 - q \quad \text{or} \quad 3q = 500 \quad q = 166.6 \quad p = 393.3
        \]
        Profit = \( 393.3 \times 166.6 - 166 \times 166 - 166 \times 50 = 166.6(393.3 - 166.6 - 50) = 29421 \)
     b) Suppose that the government establishes a fixed tax of 100,000 dollars. How does this tax scheme affect the production and profit levels of the monopolist?
        Firm goes out of business because the tax is larger than profits
     c) Suppose now that, instead of a fixed tax, the government requires the monopolist to pay a 20 dollar tax per unit sold of the good. How would this tax affect the out and equilibrium price levels of the monopolist?
        \[
        MC = MR \iff 2q + 70 = 550 - q \quad \text{or} \quad 3q = 480 \quad q = 160 \quad p = 390
        \]
        Profit = \( 390 \times 160 - 160 \times 160 - 160 \times 70 = 160(390 - 160 - 70) = 25600 \)