1. An automobile manufacturer makes a profit of $1,500 on the sale of a certain model. It is estimated that for every $100 of rebate, sales increase by 15%.

   (a) What amount of rebate will maximize profit? Use the five-step method, and model as one-variable optimization problem.

   Solution.

   (1)

   (c) Suppose that rebates actually generate only a 10% increase in sales per $100. What is the effect? What if the response is somewhere between 10 and 15% per $100 of rebate?

   Solution.

   (d) Under what circumstances would a rebate offer cause a random reduction in profit?

   Solution.

5. It is estimated that the growth rate of the fin whale population (per year) is $rx(1 - x/K)$, where $r = 0.08$ is the intrinsic growth rate, $K = 400,000$ is the maximum sustainable population, and x is the current population, now around 70,000. It is further estimated that the number of whales harvested per year is about $0.00001\,Ex$, where E is the level of fishing effort in boat-days. Given a fixed level of effort, population will eventually stabilize at the level where growth rate equals harvest rate.

   (a) What level of effort will maximize the sustained harvest rate? Model as a one-variable optimization problem using the five-step method.

   Solution.

   (1)

6. In Exercise 5, suppose that the cost of whaling is $500 per boat-day, and the price of a fin whale carcass is $6,000.

   (a) Find the level of effort that will maximize profit over the long term. Model as a one-variable optimization problem using the five-step method.

   Solution.

   (1)