1. Louis and Harvey are the only two lawyers working in New York City where they engage in Cournot competition. Weekly demand for lawyers is given by $P = 45 - Q$. Louis takes on x amount of cases per week where he faces costs $C_x(x) = 0.5x^2 + 40$. Harvey takes on y cases per week and faces costs $C_y(y) = 20y$.
   (a) What are Louis and Harvey's profit functions? Label them π_x and π_y, respectively.
   (b) What is Louis's best response function? What is Harvey's best response function?
   (c) What is the Nash Equilibrium of this model? How much does each lawyer earn in weekly profit?

2. Two firms engage in Cournot competition. They each face cost curves $C_x(x) = 8x^2$ and $C_y(y) = 6y^2 + 200$. Demand is given by $P = 261 - 4Q$ where $Q = x + y$.
   (a) What is firm X's best response function?
   (b) What is firm Y's best response function?
   (c) What is the Nash Equilibrium of this model? How much profit does each firm earn?
   (d) Suppose firm X and Y are considering forming a Cartel and splitting the profits. Would either/both of them be better off?
   (Hint: $\pi_M = \pi_x + \pi_y = -12x^2 - 10y^2 - 8xy + 261x + 261y - 200$)

3. Two firms are engaged in Stackelberg Competition. Firm X has the following cost curve $C_x(x) = 3x^2 + 4$ and firm Y faces the following cost curve $C_y(y) = y^2 + 4$. Market demand is given by $P = 60 - Q$.
   (a) What are each firm's best response functions?
   (b) Assume firm X is the leader and firm Y is the follower. What is the Nash Equilibrium of this game?
   (c) Now assume firm Y is the leader and firm X is the follower. What is the Nash Equilibrium of this game?
   (d) In terms of profit, how much does first mover's advantage help firm X? What about firm Y?

4. Two firms engage in Bertrand competition where they each face the following cost curve $C(Q_i) = 3Q_i + 3$ where $i = 1, 2$. Market demand is represented by $Q_D = 50 - P$. What is the Bertrand Nash Equilibrium? Why is this a Nash Equilibrium?