Write your name on the cover of the test booklet and nowhere else. Failure to follow these directions will cost you 1 point. The test has 150 points (to be scaled up to 200 points) and is scheduled to take 75 minutes. Therefore, expect to spend 1 minute for every 2 points. For example, a 16-point question should take 8 minutes. I can give extra time but not much.

1) (8 points) Do EITHER Part A OR Part B.
A) For the equation $F(X, Y, Z) = 3X^2Y + 4XYZ + 13$, find F''_{XX}. Show all work.
B) Why do we do the "returns-to-scale" test when testing for a valid utility function?

2) (10 points) Do EITHER Part A OR Part B.
A) If $TC = Q^2 - 3Q + 4Q^{1/2}$, then find ATC and MC.
B) Suppose you buy only colored pens and beer. If pens cost \$1/pen and beer costs \$5/beer, and your utility function is given by $U(P, B) = 5P^{1/3}B^{1/3}$. If you want to have 10 utils of utility, then what is the lowest income you could have? Set up the equation and briefly explain how you got it. **Do not solve the equations.**

3) (24 points) Find all Nash equilibria in the following matrix, if they exist. Prove that you found all and prove they are Nash equilibria. Find the cooperative solution. Explain how you found it. Find both player's safe (secure) strategy. Explain how you found it.

Payoff Matrix		Browns		
		Expensive Tickets	Medium Priced	Cheap Tickets
Steelers	Expensive Tickets	5 1	17 9	13 2
	Cheap Tickets	12 19	16 7	6 14

4) (30 points) Suppose that both firms are facing the following demand and total cost functions: $P = 126 - (Q_L + Q_F)$ and $TC_L = 10 + 4Q_L + Q_L^2$. Suppose you have determined that the follower's best response function is given by $Q_F = 26 - \frac{1}{2}Q_L$. Set up the Von Stackleberg Lagrangian. What are the outputs and profits of the two firms and the market price? Show all work.

5) (36 points) Suppose that labor costs \$16/unit and capital costs \$4/unit and the firm's production function is given by $Q = K^{1/2}L^{1/4}$. Derive formulas for the total cost for an output of Q. DO NOT calculate the value of λ. Show all work.

6) (42 points) Suppose your utility function is given by $U = 3H^{1/3}T^{1/3}$. The price of horses are \$5/horse and the price of a trailer is \$40/a trailer. Find the utility maximizing level of consumption of horses and trailers if your income is \$640. **What is the value of λ?** How much utility do you have? Suppose your income went up to \$648, then approximately how much would your utility go up?