Problem set 3

1. Answer True or False.

- A convex programming problem always has a unique global minimum point.
- If the Hessian of the Lagrange function at x*, is positive definite, the optimum design problem is convex.
- For a constrained problem, the sufficient condition at x* is satisfied if there are no feasible directions in a neighborhood of x* along which the cost function reduces.

2. A circular tank that is closed at both ends is to be fabricated to have a volume of $250\pi\ m^3$. The fabrication cost is found to be proportional to the surface area of the sheet metal needed for fabrication of the tank and is $400/m2. The tank is to be housed in a shed with a sloping roof which limits the height of the tank by the relation $H \leq 8D$, where H is the height and D is the diameter of the tank. The problem is formulated as minimize $f(D, H) = 400(0.5\pi D^2 + \pi DH)$ subject to the constraints $\frac{\pi}{4} D^2 H = 250\pi$, and $H \leq 8D$. Ignore any other constraints.

1. Check for convexity of the problem.
2. Write KKT necessary conditions.
3. Solve KKT necessary conditions for local minimum points. Check sufficient conditions and verify the conditions graphically.
4. What will be the change in cost if the volume requirement is changed to $255\pi\ m^3$ in place of $250\pi\ m^3$?

"You cannot depend on your eyes when your imagination is out of focus."
Mark Twain