1. Consider the set-up of page 4, Lecture 4, i.e., a horizontal column of soil of conductance $K$, length $L$ and cross-section area $A$. Let then column on the left be of height $h_1$ and that on the right be $h_2$ with $h_1 > h_2$. Let us start this system at time $t = 0$. Solve for $h_1(t)$ as a function of time.

2. Consider the thick-soil assumption and the lake recharge problem of page 8, Lecture 6. Verify if the variation in $h$ is small for $L = 200m, q = 30mm/day$ and $m = 20m$ and $K = 1m/day$. Interpret $\partial h/\partial x$ at $x = 0$.

3. Solve the above problem when $q = ax + b$ for some constants $a, b$.

4. Consider the Dupuit scheme for the dam problem, as on page 9, i.e., heights $H_1$ and $H_2$ separated by a separation of $L$, and a rainfall $q$. For what $q = q_0$ is $h$ so that $\partial h/\partial x = 0$ for $x = 0$. What happens when $q > q_0$.

5. Interpret the dam problem to solve the following problem. A contour trench of depth 1m and width 1m is dug on flat land. How much water does the trench recharge throughout the monsoon?

6. Consider the above system but with a two-layer separation with thicknesses $L_i$ and conductances $K_i$. Plot for $h$ when $q = 0$. 

TD 603: Water Resources
Groundwater Problem Set