The goal of Work Session 1 is to become familiar with the finite difference approach for modeling 2D fluid flow by performing calculations on a small (3x3) domain.

1. Determine the finite difference equations of cells (1,2), (2,2), and (3,3) for the 2D steady state groundwater flow equation

$$K_x \frac{\partial h^2}{\partial x^2} + K_y \frac{\partial h^2}{\partial y^2} = 0$$

   for a 3x3 domain where the top and bottom boundary are no-flow and the left and right boundaries are constant head, $H_l$and H_r, respectively. (Note: Consider the upper left-hand corner cell to be cell (1,1))

2. Solve the system of equations (which will result in the determination of the hydraulic head value of each individual cell), given the following assumptions:

   (a) Each cell is a 10m x 10m square.

   (b) $K_x = K_y = 2\frac{m^2}{day}$

   (c) $H_l = 308m$ and $H_r = 300m$

3. Add a well to the upper right hand cell of the above model (row 1, column 3). Determine the steady state head values for each cell assuming the pump removes:

   (a) 50 m/day

   (b) 150 m/day

   (c) 250 m/day

4. Do you notice anything peculiar about the system of equations you created in question 2? Does the result make sense given the assumptions? Can you think of a situation in which this phenomena would not happen?