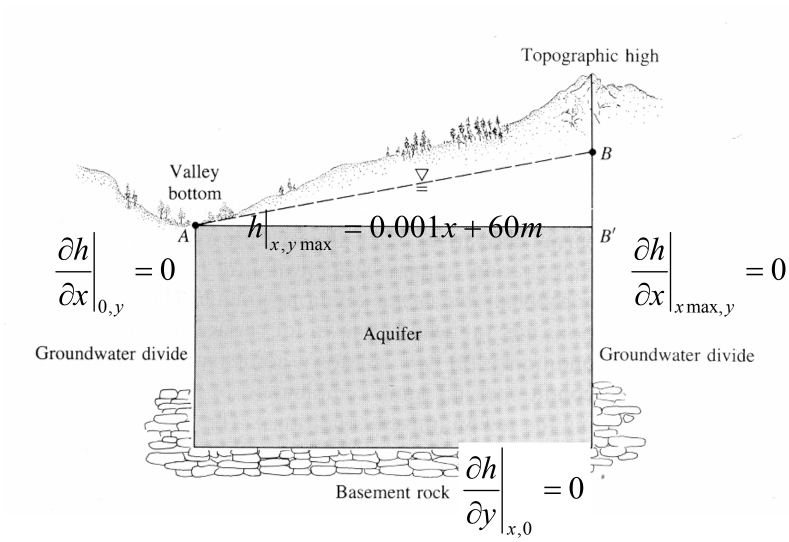
GLY 5826 Assignment 4

1. In Assignment 3 you coded an analytical solution to the 2-D Laplace equation ($\frac{\partial^2 h}{\partial x^2} + \frac{\partial^2 h}{\partial y^2} = 0$) in a domain 100 units (say meters) in the x direction and 50 m in the y direction. The head gradient was 0.001 and the head at 0 was 60 m. The boundary conditions are those represented on the following figure (Wang and Anderson, 1982):



Create an equivalent spreadsheet model and compare the results with your analytical solution by plotting equipotentials from both models on the same graph (ideally with the numerical model as open symbols over the lines of the analytical solution). If you are ambitious, you could do a node-by-node difference contour map.

Possibly helpful MATLAB code:

[c,k]=contour(x,y,h); clabel(c,k) %needs x, y vector arguments for ‘real’ coordinates

2. Choose equally spaced points along the upper boundary to start streamlines using Matlab:

```
>> [dhdx,dhdy]=gradient(h,x,y)   %needs x, y vector arguments for 'real' coordinates
>> [Stream]=stream2(x,y,-dhdx,-dhdy,[1:100],50*ones(100,1))
>> streamline(Stream)
```

(This is for stream lines starting at y = 50 from x = 11 to 100 along the x axis. Different geometries will require different starting points.)

3. Place a partially penetrating constant head ‘well’ in the model domain. Choose 2 different heads that lie between the minimum and maximum boundary heads for the well head and specify these internal ‘boundaries’ mathematically. Run the model and indicate the capture zones for each head case.

4. Do the model of Problem 2.4 in your text book on a spreadsheet. Draw equipotentials and streamlines. You may need different streamline starting points.