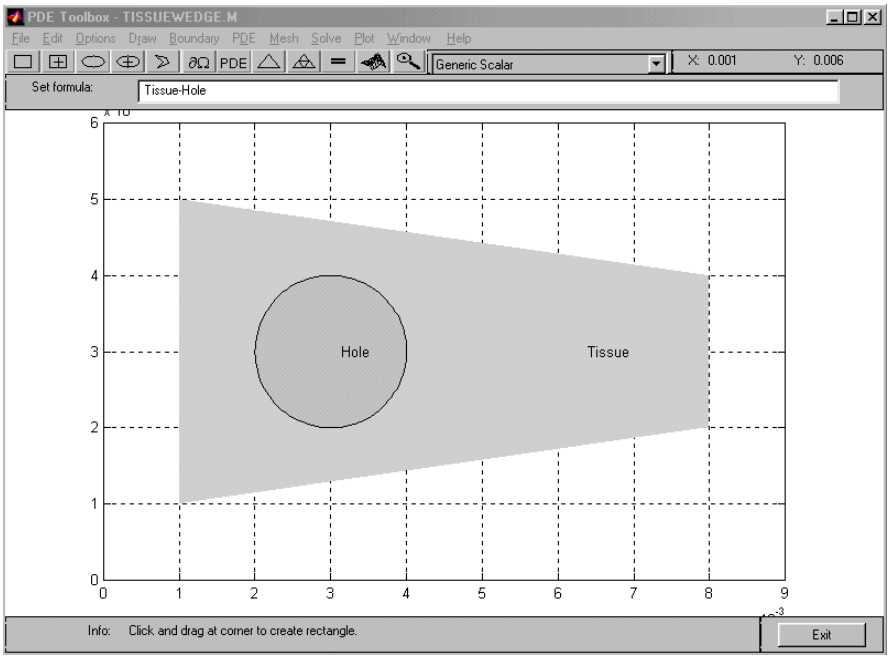
Matlab PDE Tool Problem
BE-382, Winter '08-'09, Dr. C. S. Tritt
Due 2/11

Use Matlab's PDE Toolbox (or similar software of your choice) to find the concentration distribution of oxygen in a wedge shaped tissue region. The region of interest is 7.00×10^{-3} cm long by 4.00×10^{-3} cm wide at its wider end and 2.00×10^{-3} cm wide at its narrower end. It has a 2.00×10^{-3} cm diameter hole (or impervious inclusion) located as shown. The left and right hand ends of the wedge are assumed impervious to oxygen. An artery runs along its upper edge while a vein runs along its lower edge. The artery keeps the oxygen concentration at 128 μM everywhere along the upper edge while the vein keeps the oxygen concentration at 54.0 μM everywhere along the lower edge. These values correspond to oxygen partial pressures of 95.0 and 40.0 mm Hg in the artery and vein, respectively, and a Henry's Law coefficient of 0.74 mm Hg/μM in the tissue. The diffusivity of oxygen in the tissue is assumed to be 6.3×10^{-6} cm/s^2 and the metabolic consumption rate is assumed to be 50.0 μM/s.



Hint: The following steps were executed to specify the problem geometry in MATLAB. First, start MATLAB's PDE Toolbox by entering *pdetool* at the **MATLAB** prompt. The *Options* | *Axes Limits* menu choice was used to specify axes from 0 to 0.009 cm for *x* and 0 to 0.006 cm for *y*. These values account for the 3 to 2 aspect ratio of the drawing area and provide a nicely scaled drawing. The *Option* menu was also used to activate the *Grid* and *Snap* features to make drawing easier. The tissue region was then drawn using the *Polygon* tool. Double clicking on the region allowed its label to be changed to the word *Tissue*. Next, the hole was specified using the *Centered Circle* tool and labeled *Hole*. Finally, the *Set Formula* line was changed to read *Tissue-Hole* to complete the specification of the problem geometry.