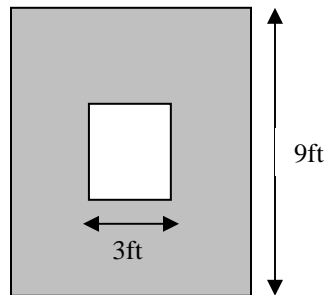


**MAE 3314: Heat Transfer**  
**Homework #4 (Due date – 9/25/07)**

1. Textbook 3.107 (4 pts)
2. Textbook 3.109 (4 pts)
3. Textbook 3.142 (4 pts)
4. Determine the steady-state heat flow rate per foot for a hollow square duct, using the numerical procedure. The material has a thermal conductivity of  $0.15 \text{ Btu/hr}\cdot\text{ft}^2\cdot^\circ\text{F}$ . The duct has its surfaces maintained at  $200^\circ\text{F}$  (inside) and  $0^\circ\text{F}$  (outside).



(a) Grid size of 1.5 ft. (2 pts)

(b) Grid size of 1.0 ft. (2 pts)

5. Saturated steam at  $400^\circ\text{F}$  is transported through the 1-ft pipe shown in the figure, which may be assumed to be at the steam temperature. The pipe is centered in the 2-ft-square duct, whose surface is at  $100^\circ\text{F}$ . If the space between the pipe and duct is filled with powdered 85% magnesia insulation, how much steam will condense in a 50-ft length of pipe? Thermal conductivity of 85% magnesia at  $212^\circ\text{F}$  is about  $0.04 \text{ Btu/hr}\cdot\text{ft}^2\cdot^\circ\text{F}$  (4 pts)

