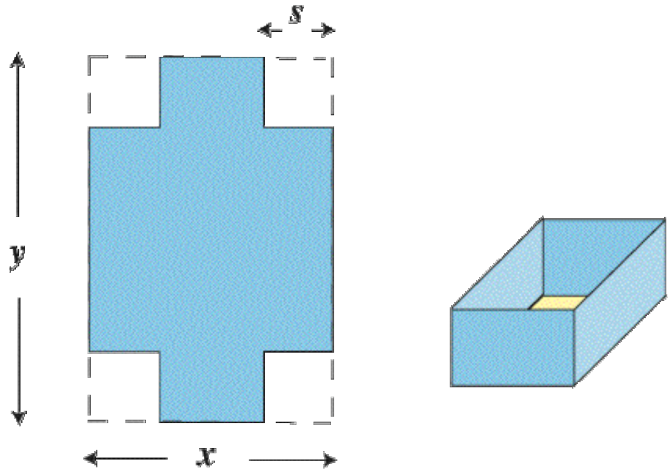
136.270

Assignment 4 (Sections 14.7, 14.8, 15.1, 15.2, 15.3)

Handed: November 24, 2004. Due: December 1, 2004 in class.
Show your work. Providing answers without justifying them will not be sufficient.

1. An open-top rectangular box of a specified volume V is to be constructed from a sheet of metal by first cutting a rectangular piece of the sheet, then cutting equal squares from the corners, folding up the remaining flaps and soldering their edges together (see the picture). Find the dimensions of the material (*x, y* and *s* in the picture) that minimize



the amount of the sheet metal used.

2. The plane $x + y + z = 1$ is heated and the temperature at any point is given by $T(x, y, z) = 4 - 2x^2 - y^2 - z^2$. Use Lagrange multipliers to find the hottest point on the plane.

3. **(a)** Evaluate $\iint_{\mathbf{R}} x \, dA$ where **R** is the region in the first quadrant bounded by $y = 0$, $y = 2$, $x = 0$, and $x = 1 + y^2$.

(b) Evaluate $\int_0^1 \int_x^1 e^{y^2} dy \, dx$.

(c) Find the volume of the solid bounded by the paraboloid $z = x^2 + y^2$ and the plane $z = 1$.