Let $g(x, y) = x^2 - 4x + y^2 - 8y + xy + 20$.

1. Find g_x and g_y.

2. Evaluate $g_x(1, 3)$ and $g_y(1, 3)$.

3. Create a 3-D plot of $z = g(x, y)$ near $(1, 3)$.
   Do your answers from #2 make sense?

4. At what point (x_0, y_0) does $z = g(x, y)$ obtain its minimum value?
   Verify your answer using a contour plot of $g(x, y)$.

1. What is the largest volume for a box that is to be constructed from 96 square inches of cardboard?
   What are the dimensions of the box that give this largest volume?

2. How does your answer from #1 change if it is an open box without a top?

3. How does your answer from #1 change if the bottom of the box needs to be reinforced with a double layer of cardboard?