

Third Examination
Thursday, April 11, 2013

Instructions: This exam should be done on your own paper. Your name should be on each sheet and on the back of the last sheet; the answers should appear written carefully and in order. If in doubt, show intermediate steps: Full credit may not be given, even for correct answers, unless work is arranged clearly and explained. This exam is closed book. You may leave after handing in your exam paper, but be sure to check your answers carefully. Each problem is worth 33 points, and 1 point is free. You may keep this exam sheet.

1. Use Lagrange multipliers to find

$$\begin{aligned} &\max x_1 + 2x_2 \\ &\text{subject to } x_1^2 + x_2^2 = 5. \end{aligned}$$

2. Compute

$$\int_{\mathcal{V}} x^2 + y^2 + z^2 dV,$$

where \mathcal{V} is the unit ball

$$x^2 + y^2 + z^2 \leq 1.$$

3. Compute the Jacobian of the transformation

$$\begin{aligned} x(s, t, u) &= s + 2t + 3u, \\ y(s, t, u) &= 4s + 5t + 6u, \\ z(s, t, u) &= 7s + 8t + 10u. \end{aligned}$$