MTH 234 - Quiz 3

Due 12 June at the beginning of class

You may work together on solving these problems, but what you turn in must be your own work written in your own words; copying another person's work is not allowed. Please present your work in a clear and organized fashion, and mark your final answers.

- 1. (7 points) A rectangular box is inscribed in a sphere of radius r; that is, the vertices of the box lie on the sphere. Show this box has volume $8r^3/3\sqrt{3}$.
- 2. (7 points) Show that the volume of the solid bounded by the cylinders $x^2 + y^2 = r$ and $y^2 + z^2 = r$ is $16r^3/3$.
- 3. (6 points) (a) Sketch the region defined by the inequalities $0 \le y \le 2$, $2y \le x \le 4$, and explain how to reverse the order of integration in

$$\int_0^2 \int_{2y}^4 f(x,y) dx \, dy$$

(b) Use the result of part (a) to evaluate

$$\int_0^2 \int_{2y}^4 e^{x^2} dx \, dy$$

Remark: The integrand in part (b) is called a Gaussian function, and it can be shown that it has no antiderivative in terms of elementary functions. This it really is necessary to change the order of integration here!