

PH.D. QUALIFYING EXAMINATION

MATHEMATICS

Spring 2014

Logistics Notes

- Time allowed: 2 hours.
- Closed book / Closed Notes (one 8.5×11.00 in. sheet of formulas is allowed).
- Calculators are allowed.
- Laptops, cell phones, and similar electronic devices are not allowed.

**Mathematics Qualifier Exam
Spring 2014**

1. Find the volume of the region R bounded by the paraboloid

$$z = 4 - x^2 - y^2$$

and the xy plane.

2. Solve the following indefinite integral

$$I = \int x \ln(x) dx ,$$

where $\ln(x)$ is the natural logarithm of x .

3. Find and classify the stationary points of the following function of two variables

$$f(x, y) = \frac{1}{3}x^3 + 3x^2 - xy^2 + 2y^2$$

4. Solve the following initial value problem by using the Laplace transform

$$\ddot{y}(t) + 6\dot{y}(t) + 8y(t) = e^{-3t}$$

With $y(0) = 1$ and $\dot{y}(0) = 0$.