PH.D. QUALIFYING EXAMINATION

ENGINEERING MATHEMATICS
FALL 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.

Problem 1

Solve the differential equation for y=f(x):

$$y''' - 6y'' + 9y' = xe^{3x} + e^{3x} \cos 2x.$$

Problem 2

A surface in a rectangular coordinate system is defined by the equation:

$$z^2 = 4 - (x^2 + y^2).$$

Determine the volume enclosed by this surface.

Problem 3

Find $y' = dy/dx$ for:

$$y = \frac{1 + x - x^2}{1 - x + x^2};$$
$$y = e^x \left(x^2 - 2x + 2 \right).$$

Problem 4

A conic is defined by the equation:

$$5x^2 - 4xy + 8y^2 - 36 = 0.$$

Describe the conic.

Hint: write the equation in matrix form, then find the rotation matrix that allows the conic to be written in standard form.