

PH.D. QUALIFYING EXAMINATION

ENGINEERING MATHEMATICS
SPRING 2015

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

Determine the area between the two curves:

$$y = (x - 1) \log(x^2 + 2)$$

and

$$y = 0$$

on the interval $[0,1]$.

Problem 2

Find the solution $y(t)$ to the following ordinary differential equation:

$$2 \frac{d^2 y}{dt^2} + 3 \frac{dy}{dt} - 2y = t \exp(-2t).$$

Problem 3

Assume that $S = \{\mathbf{v}_1, \mathbf{v}_2, \dots, \mathbf{v}_n\}$ is an orthogonal set of nonzero vectors with respect to some inner product space $\langle \rangle$. Prove that S is a linearly independent set.

Problem 4

Find the minimum distance between the lines $x = \frac{1}{2}y = \frac{1}{3}z$ and $x = y - 2 = z$.