Ph.D. Qualifying Examination

Engineering Mathematics

Spring 2017

Logistics Notes:

- Time allowed: 2 hours
- Closed book and closed notes; one sheet (8.50 11.00 in, 2-sided) of formulas is allowed
- 4 problems
- Calculators are allowed
- Laptops, cell phones, and similar electronic devices with Internet access are not allowed

Show your work, including intermediate steps. State your assumptions clearly. Use as many sheets of paper as necessary to present each solution.

Problem 1a. Compute

$$\int \frac{4x^2+2x+36}{x^3+9x}\,dx$$

Problem 1b. Compute

$$\frac{d}{dx}\left(\sqrt{\frac{x^2}{2}+1}\sqrt[3]{x^3+3}\right)$$

Problem 2. Find $y(x)$ if

$$y' + y\cos x = \frac{1}{2}\sin 2x\,,\ y(0) = 0$$

Problem 3. Evaluate

$$\lim_{\xi \to a} \frac{\sqrt{\xi} - \sqrt{a} + \sqrt{\xi - a}}{\sqrt{\xi^2 - a^2}}$$

Problem 4. Find the volume bounded by these surfaces:

$z = x^2 + y^{2,}$ $y = x^2$, $y = 1$, $z = 0$