

Midterm Exam No. 02 (2020 Spring)

PHYS 301: THEORETICAL METHODS IN PHYSICS

Department of Physics, Southern Illinois University–Carbondale

Date: 2020 Mar 3

Note: Standard identities will be provided to a student when requested.

1. **(20 points.)** Evaluate

$$\delta_{ij}\delta_{ij} = \quad (1)$$

2. **(20 points.)** Evaluate

$$\nabla r^3 = \quad (2)$$

3. **(20 points.)** Given (ρ, ϕ, z) are cylindrical coordinates. Evaluate

$$\nabla \times (\hat{\mathbf{z}} \ln \rho) = \quad (3)$$

4. **(20 points.)** Evaluate the integral

$$\int_{-1}^1 dx \delta(-x) [8x^2 + 2x - 1]. \quad (4)$$

5. **(20 points.)** Find the eigenvalues and eigenvectors of the matrix

$$\sigma_y = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}. \quad (5)$$