

Homework No. 04 (2019 Fall)

PHYS 320: Electricity and Magnetism I

Due date: Friday, 2019 Sep 6, 2:00 PM, in class

1. **(80 points.)** (Based on problem 1.44,45/1.43,44 Griffiths 4th/3rd edition.)
Evaluate the following integrals:

$$\int_2^6 dx [3x^2 - 2x - 3] \delta(x - 3) \quad (1a)$$

$$\int_{-7}^7 dx \sin x \delta(x - \pi) \quad (1b)$$

$$\int_{-\pi}^{\pi} dx \sin x \delta\left(x - \frac{3\pi}{2}\right) \quad (1c)$$

$$\int_0^3 dx x^3 \delta(x + 1) \quad (1d)$$

$$\int_{-2}^2 dx [3x + 3] \delta(3x) \quad (1e)$$

$$\int_{-2}^2 dx [3x + 3] \delta(-3x) \quad (1f)$$

$$\int_0^2 dx [3x + 3] \delta(1 - x) \quad (1g)$$

$$\int_{-1}^1 dx 9x^3 \delta(3x + 1) \quad (1h)$$

2. **(10 points.)** Evaluate the integral

$$\int_{-1}^1 \frac{\delta(1 - 3x)}{x} dx. \quad (2)$$

Hint: Be careful to avoid a possible error in sign.

3. **(30 points.)** (Based on problem 1.47/1.46 Griffiths 4th/3rd edition.)

- (a) Express the charge density $\rho(\mathbf{r})$ of a point charge Q positioned at \mathbf{r}_a in terms of δ -functions. Verify that the volume integral of ρ equals Q .
- (b) Express the charge density of an infinitely long wire, of uniform charge per unit length λ and parallel to z -axis, in terms of δ -functions.