

**MATH464, Sec. 0101: Transform Methods**  
**Department of Mathematics, UMCP**  
**Homework 8**

**Fall 2022**

**Posted:** Wednesday, 11/02/22

**Due:** Thursday, 11/10/22 IN CLASS

Answer all questions. Show all your steps and justify your answers. **Total number of pts: 80**

**Note: The use of Matlab, or any other software, is strictly NOT permitted.**

In Problems 51–53: Find the value of each of the displayed “integrals”,  $I$ . (These are symbolic integrals, not Riemann or Lebesgue integrals.)

51. (a)[5pts]

$$I = \int_{-\infty}^{\infty} \delta(x-3) e^{-\pi x^4} dx .$$

(b)[5pts]

$$I = \int_{-\infty}^{\infty} \delta'(x-1) e^{-\pi x^2} dx .$$

52. (a)[10pts]

$$I = \int_{-\infty}^{\infty} \delta''(x) e^{-\pi x^2} dx .$$

(b)[10pts]

$$I = \int_{-\infty}^{\infty} \delta'''(x) e^{-\pi x^2} dx .$$

53. (a)[5pts]

$$I = \int_{-\infty}^{\infty} [\cos(\pi x) \delta(x)] e^{-\pi x^2} dx .$$

(b)[5pts]

$$I = \int_{-\infty}^{\infty} [\sin(\pi x) \delta'(x)] e^{-\pi x^2} dx .$$

In Problems 54–57: Find and simplify the functional  $f\{\phi\}$ , where  $\phi$  is test function of the Schwartz class ( $\phi \in \mathcal{S}$ ), that is used to represent the generalized function  $f$  indicated below.

54. (a)[5pts]  $f(x) = \delta'(2x)$ . (b)[5pts]  $f(x) = \Pi'(x)$ .

55. (a)[5pts]  $f(x) = \delta''(x-6)$ . (b)[5pts]  $f(x) = \delta'''(x-5)$ .

56. [10pts]  $\widehat{f}(s) = \delta''(s)$  .

57. [10pts]

$$f(x) = \frac{27}{(x^2 + 5x + 4)^2} = \frac{2}{x+4} + \frac{3}{(x+4)^2} - \frac{2}{x+1} + \frac{3}{(x+1)^2} .$$