Name: _____

Instructors name: _____

1. Evaluate these Kronecker Delta's

   (a) [1]
   $$\sum_{i=0}^{5} ix^i \delta_{i,10}$$

   (b) [1]
   $$\sum_{i=0}^{5} ix^i \delta_{i,2}$$

   (c) [2]
   $$\sum_{i=0}^{5}\sum_{j=0}^{5} jx^i \delta_{i,j}$$

   (d) [3]
   $$\sum_{i=a}^{b}\sum_{j=c}^{d} F_i(x) F_j(x) \delta_{i,j}$$

2. Transform these integral ranges

   (a) [1]
   $$\int_0^3 x^2 \, dx \to \int_1^4$$

   (b) [1]
   $$\int_0^3 x \, dx \to \int_0^2$$

   (c) [2]
   $$\int_0^3 x^3 \, dx \to \int_1^2$$

   (d) [2]
   $$\int_{-1}^2 x + x^2 + 3 \, dx \to \int_{-4}^5$$

3. Evaluate these Dirac delta

   (a) [2]
   $$\int_0^5 \sin(x) \, e^x \delta(x) \, dx$$

   (b) [1]
   $$\int_0^5 \sin(x) \, e^{-x} + 4\delta(x-10) \, dx$$

(c) [2]

$$\int_{-5}^{5} \sin (x) + \ln (x+3) \, \delta (|x-2|) \, dx$$

(d) [3]

$$\int \int_{-5}^{5} \sin (yx) + \ln (x+3) \, \delta (x-2) \, dx \, dy$$

4. Use the orthogonality and the recursion relations to solve these

(a) [3]

$$\int_{0}^{\infty} \sum_{i=20}^{22} \sum_{j=21}^{22} x L_i' (x) \, L_j (x) \, \mathrm{e}^{-x} \, dx$$

(b) [5]

$$\int_{0}^{\infty} \sum_{i=20}^{22} \sum_{j=22}^{22} x L_i (x) \, L_j (x) \, \mathrm{e}^{-x} \, dx$$

5. Evaluate these expression with these variables

$$z_1 = 3 + i2$$

$$z_2 = 2 + i1$$

$$z_3 = 4 + i0$$

$$z_4 = 0 + i4$$

(a) [1]

$$z_1 - z_2$$

(b) [1]

$$z_1 z_4$$

(c) [2]

$$\frac{z_1}{z_2}$$

(d) [3]

$$\frac{z_1}{z_2} z_2 + z_3$$

(e) [3]

$$\frac{z_1}{z_2} z_1^* + z_3$$

6. Compute the Fourier transforms of

(a) [5]

$$\mathrm{e}^{-\pi t^2}$$

(b) [5]

$$t^2 \mathrm{e}^{-t}$$