

Physics 129a
Problem Set Number 2
Due Tuesday, October 13, 2009

Reading: Sections 4–5.2 of the note (posted on the course web page) on “Integral Equations”. We’ll save remainder of section 5 and the material on symmetric kernels in section 6 until next week.

5. Consider the Fourier transform of $e^{-\mu r}/r$, where $\mu > 0$ is real, and r is the radial coordinate.

(a) Find the Fourier transform in two dimensions ($r = \sqrt{x^2 + y^2}$). That is, compute:

$$\frac{1}{2\pi} \int_{-\infty}^{\infty} e^{-ip_x x} dx \int_{-\infty}^{\infty} e^{-ip_y y} dy \frac{e^{-\mu r}}{r}. \quad (1)$$

(b) Find the Fourier transform in three dimensions ($r = \sqrt{x^2 + y^2 + z^2}$).

6. Laplace’s method: Exercise 15 in the Integral Equations course note.

7. Solve the following integral equations for $f(x)$:

(a)

$$f(x) = e^x + \lambda \int_0^2 xyf(y)dy. \quad (2)$$

(b)

$$f(x) = \lambda \int_0^\pi \sin(x - y)f(y)dy. \quad (3)$$

What happens for different values of λ ?

8. One more Laplace transform exercise: Exercise 23 in the Integral Equations course note.