PHZ 3113 Fall 2017

Homework #7, Due Monday, October 23

1. Show that $\delta(x)\,g(x) = \delta(x)\,g(0)$. [Consider the result of integrating each against an arbitrary well-behaved function $f(x)$.]

2. Given that $\nabla^2 \dfrac{1}{r} = -4\pi\,\delta^{(3)}(\boldsymbol{r})$,

(a) Show that $(\nabla^2 + k^2)\,\dfrac{e^{ikr}}{r} = -4\pi\,\delta^{(3)}(\boldsymbol{r})$.

(b) Show that $\psi(\boldsymbol{r}) = \displaystyle\int d^3x'\,\frac{e^{ik|\boldsymbol{r}-\boldsymbol{r}'|}}{|\boldsymbol{r}-\boldsymbol{r}'|}\,j(\boldsymbol{r}')$ is a solution to $(\nabla^2 + k^2)\,\psi(\boldsymbol{r}) = -4\pi j(\boldsymbol{r})$.

3. Is $(i^i)^i$ real, imaginary, or complex? Is $i^{(i^i)}$ real, imaginary, or complex?

4. Find all z such that $\cos z = i$.

5. Compute $\displaystyle\int_0^{2\pi} \frac{d\theta}{1 + \sin\alpha\,\sin\theta}$.