Homework 15

(Due Date: Start of class on Thurs. May 3)

1. Complete your final project. (*Note:* although it is my general policy to drop your lowest single homework score this term, this project is NOT one that you can drop!)

Only one group member should submit the final report. Be sure to include all group members' names on the front page. To submit, create a .pdf document and upload it to the D2L "DISCUSSION" area we have specifically created for this purpose. (It appears as the very last discussion topic - look for it. It is NOT the same as the one where your progress report went two weeks ago)

Please also SEPARATELY upload your mathematica notebook (or other working code).

So you'll upload two things: report, and code.

For more details see `http://www.colorado.edu/physics/phys2210/phys2210_sp12/project_info.html`

Danny and I have created a "sample" project report (available on D2L) so you can see an example of what we have in mind. No need to copy our format exactly, it's just there to provide you with helpful ideas.

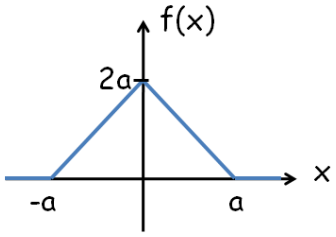
2. AFTER completing your project please visit the online survey at

`http://goo.gl/g5cDc`

Note: As always, full credit just for inputting your name and ID. Because we have a bunch of questions about the project, the due date for this question is extended to Friday May 4 at 5 PM. Please don't forget to do it! (It will still be open right up to the final, though after Friday we can't give homework credit for it - but we will still appreciate and make use of your thoughtful feedback)

NOTE: The rest of this set is entirely optional. It is not to be turned in (it's not extra credit), but I will provide solutions to these questions online. Although the detailed mathematics of Fourier transforms will not be heavily featured on the final exam, some basic conceptual or computational ideas (which these problems will help you work through) might appear. This is the last topic we cover for which you have responsibility on the final

(a) Show that if a function $f(x)$ is even, then its Fourier transform $g(\alpha)$ (as defined in Boas Ch 7, Eq 12.2) is also an even function.



For the function shown above:

(b) Qualitatively, how do you expect $g(\alpha)$, the Fourier transform of $f(x)$, to change if you make a bigger or smaller?

(c) Find the Fourier transform $g(\alpha)$.

(d) Sketch $g(\alpha)$ (or plot it in Mathematica if you prefer). Was your prediction in part (a) correct? Explain.

(e) I claim that the Fourier Transform of a gaussian function with standard deviation σ, $f(x) = e^{-x^2/(2\sigma^2)}$, is itself also a Gaussian function, $g(\alpha)$. How do you expect the standard deviation of $g(\alpha)$ to depend on σ?