ph260 Theoretical Physics 2 — workshop 4

1. Laplace equation.
Determine the temperature profile in a long thin plate 10 length units wide and kept at zero temperature at the long sides and the far short edge. It is heated at one corner of the remaining short edge; the resulting temperature profile at the edge is approximately proportional to x. Let the long side be orientated along the y axis.

2. Laplace equation in a finite plate.
Same as above, but chop the long plate off at 30 length units and keep it at zero temperature there.

3. Diffusion equation.
A bar 20 length units long with insulated sides is initially at 100 temperature units, except for the ends, which are kept at zero temperature throughout the experiment. Find the temperature distribution in the bar at time t.

4. Even and odd expansions.
In the lecture, we have extended a non-periodic function, which is defined in a limited range only, to an odd periodic function (*odd* meaning $f(-x) = -f(x)$), so that we were able to expand it in a sine series. The function used in the example was $f(x) = \{^{1\ (0<x<\pi)}_{0\ (\text{otherwise})}$. We could just as well have extended $f(x)$ to an *even* function ($f(-x) = f(x)$) and expanded it into a cosine series. Try it, find the coefficients, and show that the result is the same within the range in which $f(x)$ is defined by plotting the first terms.

Acknowledgement.
Examples 1-3 are stolen or adapted from *ML Boas; Mathematical Methods in the Physical Sciences, John Wiley, New York (USA) [2]1983.*

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