

Physics 237 Problem Set #4

In preparation for the quiz on Tuesday, 17 February 2026

All but the last one are problems from chapter 2 of Griffiths & Schroeter.

If you haven't taken PHYS 217 and/or MATH 281, do

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If you have, then it is your responsibility to be in a workshop group with others who have not, and to lead them through these problems. (They were homework problems last semester in PHYS 217.)

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2.42. By now you must be bored by all the expectation values you have calculated; parts d and e are therefore optional.

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A. Prove the **convolution theorem**:

Suppose $f(x)$ and $g(x)$ have Fourier transforms $F(k)$ and $G(k)$ respectively. Suppose $h(x)$, with Fourier transform $H(k)$, is the **convolution** of f and g :

$$h(x) = \int_{-\infty}^{\infty} f(u) g(x-u) du \quad .$$

Then
$$H(k) = \sqrt{2\pi} F(k) G(k) \quad ;$$

that is, convolution is the same as multiplication of Fourier transforms.