# HW Quiz 5

Work one of the following problems:

1. For what range of $\nu$ is the function $f(x) = x^{\frac{\nu}{2}+1}$ in Hilbert space on the interval (-1,0)? You may assume that $\nu$ is real but not necessarily positive.

Need $\int_{-1}^{0} f^* f\,dx < \infty \Rightarrow \int_{-1}^{0} x^{v+2}\,dx = \left[\frac{x^{v+3}}{v+3}\right]_{-1}^{0} = \frac{\overbrace{0^{v+3}}^{\text{blows up if } v+3<0}}{v+3} - \frac{(-1)^{v+3}}{\underbrace{v+3}_{\text{blows up if } v+3=0}}$

So to avoid getting $\infty$ we require $v+3>0$ or $\boxed{v>-3}$

2. If $\hat{Q}$ is a Hermitian Operator, reduce the following expression to a single term:

$$\langle \hat{Q}f \mid g\rangle - \underbrace{\langle if \mid \hat{Q}ig\rangle} + \langle f \mid \hat{Q}g\rangle + \langle \hat{Q}f \mid ig\rangle + \langle if \mid \hat{Q}g\rangle = ?$$

$$\langle \hat{Q}f|g\rangle - i^* i\langle \hat{Q}f|g\rangle + \langle \hat{Q}f|g\rangle + i\langle \hat{Q}f|g\rangle + i^*\langle \hat{Q}f|g\rangle$$

$$\cancel{\langle \hat{Q}f|g\rangle} - \cancel{\langle \hat{Q}f|g\rangle} + \langle \hat{Q}f|g\rangle + \cancel{i\langle \hat{Q}f|g\rangle} - \cancel{i\langle \hat{Q}f|g\rangle} = \boxed{\langle \hat{Q}f|g\rangle \text{ or } \langle f|\hat{Q}g\rangle}$$