

**2.4** Let  $\psi(x)$  be a properly normalised wavefunction and  $Q$  an operator on wavefunctions. Let  $\{q_r\}$  be the spectrum of  $Q$  and  $\{u_r(x)\}$  be the corresponding correctly normalised eigenfunctions. Write down an expression for the probability that a measurement of  $Q$  will yield the value  $q_r$ . Show that  $\sum_r P(q_r|\psi) = 1$ . Show further that the expectation of  $Q$  is  $\langle Q \rangle \equiv \int_{-\infty}^{\infty} \psi^* \hat{Q} \psi \, dx$ .<sup>1</sup>