Tutorial

1. Consider the operator,

$$\hat{A} = x\frac{d}{dx}$$

a. Which of the following wavefunctions are eigenfunctions of $\hat{A}$?

$$\psi_1(x) = \cos(x),$$

$$\psi_2(x) = \exp(x),$$

$$\psi_3(x) = x^2,$$

and

$$\psi_4(x) = x^{-1}.$$

b. What are the associated eigenvalues?

2. The inner product for wavefunctions of a radial coordinate takes the form,

$$\langle \psi | \varphi \rangle = \int_0^\infty \psi^*(r)\varphi(r)\, r\, dr.$$

For what value of c is the wavefunction,

$$\psi(r) = c\, \exp(-r),$$

normalized - i.e., $\langle \psi | \psi \rangle = 1$.