Tutorial

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name student number

1. Evaluate the following integrals:

a.

$$\int_0^\infty \exp(-x)\, dx$$

b.

$$\int_0^\infty \exp(-2x)\, dx$$

c.

$$\int_0^\infty \int_0^\infty \exp(-x-y)\, dxdy$$

d.

$$\int_0^\infty \int_0^\infty xy \exp(-x-y)\, dxdy.$$

2. Suppose that

$$\langle \psi_1 | \psi_1 \rangle = 1,$$

$$\langle \psi_2 | \psi_2 \rangle = 1,$$

$$\langle \psi_1 | \psi_2 \rangle = 0$$

and

$$\psi(x) = \frac{1}{\sqrt{2}} \psi_1(x) + \frac{i}{\sqrt{2}} \psi_2(x)$$

Evaluate the following inner products:

a.

$$|\langle \psi_1 | \psi \rangle|^2$$

b.

$$|\langle \psi_2 | \psi \rangle|^2$$

c.

$$|\langle \psi | \psi \rangle|^2$$

d. Suppose that $\psi_1(x)$ and $\psi_2(x)$ are eigenfunctions of operator $\hat{A}$, associated with eigenvalues, a_1 and a_2, respectively. If a quantum system is in state, $\psi(x)$ (see above), then what is the probability of a measurement of $\mathcal{A}$ (the observable represented by $\hat{A}$) yielding the value a_2?