CH1101 : Elements of Chemistry

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1. An *eigenfunction* of a given operator D is any (non-zero) function f which, when operated upon by D, gets multiplied by some scalar λ called its *eigenvalue*, i.e.,
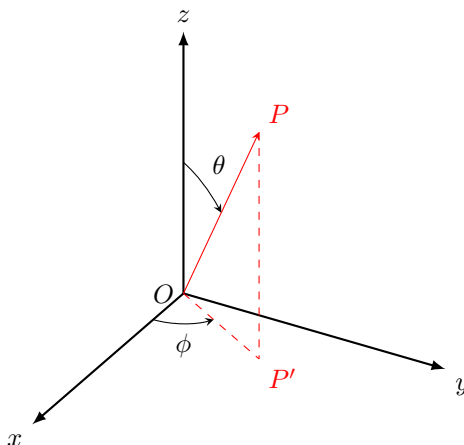
$$Df \;=\; \lambda f.$$

For example, consider the differentiation operator $D_x = \frac{\mathrm{d}}{\mathrm{d}x}$. Note that

$$D_x \exp(kx) \;=\; k \cdot \exp(kx).$$

Thus, $\exp(kx)$ is an eigenfunction of the operator D_x, with an eigenvalue of k.

2. Below is the point $P(x, y, z)$ in a spherical polar coordinate system.

$$r \;=\; \sqrt{x^2 + y^2 + z^2}$$
$$\theta \;=\; \arccos\left(\frac{z}{\sqrt{x^2 + y^2 + z^2}}\right)$$
$$\phi \;=\; \arctan\left(\frac{y}{x}\right)$$

We must have $r \geq 0$, $0 \leq \theta \leq \pi$ and $0 \leq \phi \leq 2\pi$.