

P1.15 A beam of electrons with a speed of 4.75×10^4 m/s is incident on a slit of width 235 nm. The distance to the detector plane is chosen such that the distance between the central maximum of the diffraction pattern and the first diffraction minimum is 0.375 cm. How far is the detector plane from the slit?

Q2.4 Why is it true for any quantum mechanical problem that the set of wave functions is larger than the set of eigenfunctions?

P2.17 Determine in each of the following cases if the function in the first column is an eigenfunction of the operator in the second column. If so, what is the eigenvalue?

$$e^{-i(3x+2y)}$$

$$\frac{\partial^2}{\partial x^2}$$

$$\sqrt{x^2 + y^2}$$

$$(1/x)(x^2 + y^2) \frac{\partial}{\partial x}$$

$$\sin \theta \cos \theta$$

$$\sin \theta \frac{d}{d\theta} \left(\sin \theta \frac{d}{d\theta} \right) + 6 \sin^2 \theta$$

P2.25 Make the three polynomial functions $a_0, a_1 + b_1x$, and $a_2 + b_2x + c_2x^2$ orthonormal in the interval $-1 \leq x \leq +1$ by determining appropriate values for the constants a_0, a_1, b_1, a_2, b_2 , and c_2 .