4)

$$x = \frac{e}{\sqrt{2}}(a + a^+) \qquad p = \frac{\hbar}{\sqrt{2}e\,i}(a - a^+)$$

$$x^2 = \frac{e^2}{2}(a^2 + a^{+2} + aa^+ + a^+a) = \frac{e^2}{2}(a^2 + a^{+2} + 2n + 1)$$

$$p^2 = -\frac{\hbar^2}{2e}(a^2 + a^{+2} - 2n + 1) \qquad n = a^+a$$

$$x^2|n\rangle = \frac{e^2}{2}\left[\sqrt{n(n-1)}\,|n-2\rangle + \sqrt{(n+1)(n+2)}\,|n+2\rangle + (2n+1)|n\rangle\right]$$

$$p^2|n\rangle = -\frac{\hbar^2}{2e}\left[\sqrt{n(n-1)}\,|n-2\rangle + \sqrt{(n+1)(n+2)}\,|n+2\rangle - (2n+1)|n\rangle\right]$$

$$\langle 3|p^{2n+1}|3\rangle = \int dx\, \psi_3(x)(-i\hbar)^{2n+1}\frac{\partial^{2n+1}}{\partial x^{2n+1}}\psi_3(x)$$

ψ_3 dispari $\qquad \frac{\partial^{2n+1}}{\partial x^{2n+1}}\psi_3$ ha parità $(-1)^{2n+1}(-1) = $ pa

$$\langle 3|p^{2n+1}|3\rangle = 0$$