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(a)

$$\{A,B\} = \sum_i \left(\frac{\partial A}{\partial q_i}\frac{\partial B}{\partial p_i} - \frac{\partial A}{\partial p_i}\frac{\partial B}{\partial q_i}\right)$$

$$\{x^2,p^2\} = \frac{\partial x^2}{\partial x}\frac{\partial p^2}{\partial p} - \frac{\partial x^2}{\partial p}\frac{\partial p^2}{\partial x} = 4xp$$

(b)

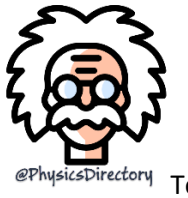
$$[X^2,P^2] = 2i\hbar(XP+PX) = 2i\hbar(XP+XP-i\hbar) = 4i\hbar XP + 2\hbar^2$$

(c)

We know that in quantum mechanics XP is different from PX and $XP - PX = i\hbar$ but when $\hbar \to 0$ (Classical Limit!) $XP = PX$ thus

$$[x^2,p^2] = 2i\hbar(xp+xp) = 4i\hbar xp = i\hbar\{x^2,p^2\}$$

Mohammad Behtaj & Adel Sepehri

Translate by: 

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