Answer on question #86636, Physics / Atomic and Nuclear Physics:

Given:

$$A = a\hat{x} + ib\hat{p}$$

Where, a and b are constants and $\hat{x}$ and $\hat{p}$ position and momentum operator.

To find:

[A , $\hat{x}$] and [A , A]

Solution:

(1) [A , $\hat{x}$]

= $[a\hat{x} + ib\hat{p},]$

= a[$\hat{x}$, $\hat{x}$] + ib [$\hat{p}$, $\hat{x}$]

But $[\hat{x} , \hat{x}] = 0$ and $[\hat{p} , \hat{x}] = -i\hbar$

= ib*$(-i\hbar)$

= b*$\hbar$

(2) [A , A]

= $[a\hat{x} + ib\hat{p} , a\hat{x} + ib\hat{p}]$

= a^2 [$\hat{x}$, $\hat{x}$] + iab [$\hat{x}$, $\hat{p}$] + iab [$\hat{p}$, $\hat{x}$] – b^2 [$\hat{p}$, $\hat{p}$]

But $[\hat{x} , \hat{x}] = 0$, $[\hat{x} , \hat{p}] = i\hbar$, $[\hat{p} , \hat{x}] = -i\hbar$ and $[\hat{p} , \hat{p}] = 0$

= - ab + ab

= 0