Answer on Question #85019 – Math – Complex Analysis

Question

For the operator A=ax+ibp where a and b are constants, calculate [A,x] and [A,A].

Solution

Fundamental commutation relation: $[x, p] = i\hbar$

$$[A, x] = [ax + ibp, x] = a[x, x] + ib[p, x] = ib(-i\hbar) = b\hbar$$

$$[A, A] = [ax + ibp, ax + ibp] = a[x, ax + ibp] + ib[p, ax + ibp]$$
$$= a^2[x, x] + iab[x, p] + iab[p, x] - b^2[p, p] = 0 + iab(i\hbar - i\hbar) + 0 = 0$$

Answer: $[A, x] = b\hbar$ and $[A, A] = 0$.