$v_1 = a_{11} D_1 + a_{21} D_2 \qquad v_2 = a_{12} D_1 + a_{22} D_2$

$\Rightarrow v_1^2 = a_{11}^2 D_1^2 + a_{21}^2 D_2^2 + a_{11} a_{21} D_1 D_2 + a_{21} a_{11} D_2 D_1$
$+ \sum \square D_i$

$$\Rightarrow |v_1^2 \varphi|^2 \le K_1 (|D_1^2 \varphi|^2 + |D_2^2 \varphi|^2 + |D_1 D_2 \varphi|^2 + |D_2 D_1 \varphi|^2 + |D_1 \varphi|^2 + |D_2 \varphi|^2)$$

In the same way, we get

$$|v_2^2 \varphi|^2 \le K_2 (|D_1^2 \varphi|^2 + |D_2^2 \varphi|^2 + |D_1 D_2 \varphi|^2 + |D_2 D_1 \varphi|^2 + |D_1 \varphi| + |D_2 \varphi|^2)$$

$$|v_1 v_2 \varphi|^2 \le K_3 (\quad \cdots \quad)$$

$$|v_2 v_1 \varphi|^2 \le K_4 (\quad \cdot \quad)$$

$$\Rightarrow |\varphi(x)|^2 + |v_1^2 \varphi|^2 + |v_2^2 \varphi|^2 + |v_1 v_2 \varphi|^2 + |v_2 v_1 \varphi|^2 + |v_1 \varphi|^2 + |v_2 \varphi|^2$$
$$\le K (|D_1^2 \varphi|^2 + |D_2^2 \varphi|^2 + |D_1 D_2 \varphi|^2 + |D_2 D_1 \varphi|^2 + |D_1 \varphi|^2 + |D_2 \varphi|^2 + |\varphi|^2)$$

$$\Rightarrow \sum_{[\alpha] \le 2} \int_V p(x) |v^\alpha \varphi(x)|^2 dx \le K \sum_{[\alpha] \le 2} \int_V |D^\alpha \varphi(x)|^2 dx$$

In the same way, we get

$$\sum_{[\alpha] \le 2} \int_V |D^\alpha \varphi(x)|^2 dx \le C_2 \sum_{[\alpha] \le 2} \int_V p(x) |v^\alpha \varphi(x)|^2 dx$$

$\Rightarrow$ We proved $\exists\ C_1\ C_2 > 0$ s.t

$$C_1 \int_V \sum |D^\alpha \varphi(x)|^2 dx < \sum_{[\alpha] \le 2} \int_V p(x) |v^\alpha \varphi(x)|^2 dx < C_2 \sum \int_V |D^\alpha \varphi(x)|^2 dx$$

which shows the equivalence. We can guess for general cases.