v_2 intersects with E at $(1, 0, (\alpha_{21}-\alpha_{20}), 0)$.

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①

E'

$$\Rightarrow \lim_{h\to 0} \frac{(1, 0, (\alpha_{11}-\alpha_{10}), 0) - (1+h, 0, (\alpha_{11}-\alpha_{10})(1+h), 0)}{h}$$

$$= -(1, 0, \alpha_{11}-\alpha_{10}, 0) \in T_p(\mathbb{C}^2\times\mathbb{C}^2)$$

E' $k=1$

$$\lim_{h\to 0} \frac{(1, 0, (\alpha_{11}-\alpha_{10}), 0) - (1, h, (\alpha_{11}-\alpha_{10}), (\alpha_{12}-\alpha_{10})h)}{h}$$

$$= -(0, 1, 0, (\alpha_{12}-\alpha_{10})) \in T_p(\mathbb{C}^2\times\mathbb{C}^2)$$

②

$$v_2 : \mathbb{C}^2 \longrightarrow \mathbb{C}^2\times\mathbb{C}^2$$

$$(x_1, x_2) \longmapsto (x_1, x_2, (\alpha_{21}-\alpha_{20})x_1, (\alpha_{22}-\alpha_{20})x_2)$$

$$v_{2*} : T\mathbb{C}^2 \longrightarrow T_p(\mathbb{C}^2\times\mathbb{C}^2)$$

$$\begin{pmatrix} x \\ y \end{pmatrix} \longmapsto \begin{pmatrix} 1, & 0 \\ 0, & 1 \\ \alpha_{21}-\alpha_{20}, & 0 \\ 0, & \alpha_{22}-\alpha_{20} \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\Rightarrow \operatorname{im} v_{2*} = \langle (1, 0, \alpha_{21}-\alpha_{20}, 0), (0, 1, 0, \alpha_{22}-\alpha_{20}) \rangle$$

$$\Rightarrow \det\begin{pmatrix} 1, & 0, & 0, & 0 \\ 0, & 1, & 0, & \alpha_{12}-\alpha_{10} \\ 1, & 0, & \alpha_{21}-\alpha_{20}, & 0 \\ 0, & 1, & 0, & \alpha_{22}-\alpha_{20} \end{pmatrix} = \det\begin{pmatrix} \alpha_{21}-\alpha_{20} & 0 \\ 0 & \alpha_{22}-\alpha_{20} \end{pmatrix} \neq 0$$