The simplest way to calculate the intersection is to keep the auxiliary variables s_1, s_2, i_1 and i_2 without expanding them.

$$s_1 = \frac{y_{11} - y_{12}}{x_{11} - x_{12}} \qquad i_1 = y_{11} - s_1 x_{11}$$

$$s_2 = \frac{y_{21} - y_{22}}{x_{21} - x_{22}} \qquad i_2 = y_{21} - s_2 x_{21}$$

Then

$$\begin{cases} x_0 = \dfrac{i_2 - i_1}{s_1 - s_2} \\ y_0 = s_1 x_0 + i_1 \end{cases}$$