



$$in: P_i(x_i, y_i), \quad P_i \neq P_j : i \neq j$$

$$out: d_0^2 = \left(\frac{OP_0}{OP_2} \right)^2 \quad d_1^2 = \left(\frac{OP_1}{OP_3} \right)^2$$

$$a_{00} = y_2 - y_0$$

$$a_{01} = -(x_2 - x_0)$$

$$a_{10} = y_3 - y_1$$

$$a_{11} = -(x_3 - x_1)$$

$$\Delta = \begin{vmatrix} a_{00} & a_{01} \\ a_{10} & a_{11} \end{vmatrix} \left\{ \begin{array}{l} \Delta \neq 0: \quad \begin{cases} b_0 = -(x_2 - x_0) \cdot y_0 + (y_2 - y_0) \cdot x_0 \\ b_1 = -(x_3 - x_1) \cdot y_1 + (y_3 - y_1) \cdot x_1 \\ \Delta_x = \begin{vmatrix} b_0 & a_{01} \\ b_1 & a_{11} \end{vmatrix} \quad \Delta_y = \begin{vmatrix} a_{00} & b_0 \\ a_{10} & b_1 \end{vmatrix} \\ OP_i^2 = \left(\frac{\Delta_x}{\Delta} - x_i \right)^2 + \left(\frac{\Delta_y}{\Delta} - y_i \right)^2 \end{cases} \quad d_i^2 = \frac{OP_i^2}{OP_{i+2}^2} \\ \Delta = 0: no \ solution \end{array} \right.$$