



**Example 180 :** As shown in Figure 3, there are four circles on the plane  $C_1$ ,  $C_2$ ,  $C_3$ ,  $C_4$ .  $C_1$  Intersecting  $C_2$  at  $Z_1$  sum  $W_1$ ,  $C_2$  intersecting  $C_3$  at  $Z_2$  sum  $W_2$ ,  $C_3$  intersecting  $C_4$  at  $Z_3$  sum  $W_3$ ,  $C_4$  intersecting  $C_1$  at  $Z_4$  sum  $W_4$ , to prove  $Z_1$  that,  $Z_2$ ,  $Z_3$ ,  $Z_4$  the necessary and sufficient condition for the four points to be in the same circle is that  $W_1$ ,  $W_2$ ,  $W_3$ ,  $W_4$  the four points are in the same circle.

$$\frac{Z_1 - Z_2}{W_2 - Z_2} \frac{Z_2 - Z_3}{W_3 - Z_3} \frac{Z_3 - Z_4}{W_4 - Z_4} \frac{Z_4 - Z_1}{W_1 - Z_1} = \frac{Z_1 - Z_2}{Z_3 - Z_2} \frac{W_1 - W_2}{W_3 - W_2} \cdot \frac{Z_1 - W_1}{Z_1 - Z_4} \frac{Z_2 - W_2}{Z_3 - W_3} \frac{Z_3 - W_3}{W_4 - W_3} \frac{Z_4 - W_4}{W_1 - W_4} \frac{Z_4 - Z_1}{Z_3 - Z_4} \frac{W_1 - W_4}{W_3 - W_4}.$$