$$Au^2 + 2Buv + Cv^2 + 2Du + 2Ev + F = 0$$

$$Ax_c^2 + 2Bx_c y_c + Cy_c^2 + 2\frac{D}{f} x_c z_c + 2\frac{E}{f} y_c z_c + \frac{F}{f^2} z_c^2 = 0$$

$$Ax_c^2 + 2Bx_c y_c + Cy_c^2 + 2\frac{D}{f} x_c(\alpha x_c + \beta y_c + \gamma) + 2\frac{E}{f} y_c(\alpha x_c + \beta y_c + \gamma) + \frac{F}{f^2}(\alpha x_c + \beta y_c + \gamma)^2 = 0$$

$$\boxed{\begin{aligned} & Ax_c^2 + 2Bx_c y_c + Cy_c^2 + \\ & 2\frac{D}{f}\alpha x_c^2 + 2\frac{D}{f}\beta x_c y_c + 2\frac{D}{f}\gamma x_c + \\ & 2\frac{E}{f}\alpha x_c y_c + 2\frac{E}{f}\beta y_c^2 + 2\frac{E}{f}\gamma y_c + \\ & \frac{F}{f^2}(\alpha^2 x_c^2 + +2\alpha\beta x_c y_c + \beta^2 y_c^2 + 2\alpha\gamma x_c + 2\beta\gamma y_c + \gamma^2) = 0 \end{aligned}}$$

$$(A + 2\frac{D}{f}\alpha + \frac{F}{f^2}\alpha^2)x_c^2 + (C + 2\frac{E}{f}\beta + \frac{F}{f^2}\beta^2)y_c^2 + 2(B + \frac{D}{f}\beta + \frac{E}{f}\alpha + \frac{F}{f^2}\alpha\beta)x_c y_c +$$
$$2(\frac{D}{f}\gamma + \frac{F}{f^2}\alpha\gamma)x_c + 2(\frac{E}{f}\gamma + \frac{F}{f^2}\beta\gamma)y_c + \frac{F}{f^2}\gamma^2 = 0$$