a) We can expand the equation:

$$\begin{aligned} z &= a(x^2 - 2xx_0 + x_0^2 + y^2 - 2yy_0 + y_0^2) + z_0 \\ &= a(x^2 + y^2) - 2ax_0x - 2ay_0y + (ay_0^2 + ax_0^2 + z_0) \\ &= a(x^2 + y^2) - bx - cy + d \end{aligned}$$

Where a, b, c, and d are our new parameters, and the original parameters can be found:

$$\begin{aligned} a &= a \\ x_0 &= \frac{b}{2a} \\ y_0 &= \frac{c}{2a} \\ z_0 &= d - \frac{1}{4a}(b^2 + c^2) \end{aligned}$$

This problem is now linear in these new parameters!

b) The best-fit parameters are shown in p3_out.txt. First are the modified parameters a, b, c, and d, and then the original parameters a, x_0, y_0, and z_0.

c) From the residuals (see Figure 1, p3_fig1.png), I estimated the noise to be about 2.8 meters. Not really sure how to do the rest of this question.