

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!