$$\frac{\partial z^4}{\partial \theta_1} = \frac{\partial z^4}{\partial z_1^3}\frac{\partial z_1^3}{\partial \theta_1} + \frac{\partial z^4}{\partial z_2^3}\frac{\partial z_2^3}{\partial \theta_1}$$

$$= \frac{\partial z^4}{\partial z_1^3}\left(\frac{\partial z_1^3}{\partial z_1^2}\frac{\partial z_1^2}{\partial \theta_1} + \frac{\partial z_1^3}{\partial z_2^2}\frac{\partial z_2^2}{\partial \theta_1}\right)$$

$$+ \frac{\partial z^4}{\partial z_2^3}\left(\frac{\partial z_2^3}{\partial z_1^2}\frac{\partial z_1^2}{\partial \theta_1} + \frac{\partial z_2^3}{\partial z_2^2}\frac{\partial z_2^2}{\partial \theta_1}\right)$$