$f(x,y,z) = x^4 + y^4 + z^4,\ g(x,y,z) = x^2 + y^2 + z^2 = 1 \quad \Rightarrow \quad \nabla f = \left\langle 4x^3, 4y^3, 4z^3 \right\rangle$, $\lambda \nabla g = \langle 2\lambda x, 2\lambda y, 2\lambda z\rangle$.

*Case 1:* If $x \neq 0,\ y \neq 0$ and $z \neq 0$ then $\nabla f = \lambda \nabla g$ implies $\lambda = 2x^2 = 2y^2 = 2z^2$ or $x^2 = y^2 = z^2 = \frac{1}{3}$ yielding 8 points each with an $f$-value of $\frac{1}{3}$.

*Case 2:* If one of the variables is 0 and the other two are not, then the squares of the two nonzero coordinates are equal with common value $\frac{1}{2}$ and the corresponding $f$-value is $\frac{1}{2}$.

*Case 3:* If exactly two of the variables are 0, then the third variable has value $\pm 1$ with corresponding $f$-value of 1. Thus on $x^2 + y^2 + z^2 = 1$, the maximum value of $f$ is 1 and the minimum value is $\frac{1}{3}$.