$f(x,y) = 4x + 4y,\ \ g(x,y) = x^2 + y^2 = 8 \quad \Rightarrow \quad \nabla f = \langle 4, 4 \rangle$,
$\lambda \nabla g = \langle 2\lambda x, 2\lambda y \rangle$. Then $2\lambda x = 4$ and $2\lambda y = 4$ imply $x = \dfrac{2}{\lambda}$ and
$y = \dfrac{2}{\lambda}$. But $8 = x^2 + y^2 = \left(\dfrac{2}{\lambda}\right)^2 + \left(\dfrac{2}{\lambda}\right)^2 \quad \Rightarrow \quad 8 = \dfrac{8}{\lambda^2} \quad \Rightarrow$
$\lambda = \pm 1$, so f has possible extreme values at the points $(2,2)$, $(-2,-2)$. We compute $f(2,2) = 16$ and $f(-2,-2) = -16$, so the maximum value of f on $x^2 + y^2 = 8$ is $f(2,2) = 16$ and the minimum value is $f(-2,-2) = -16$.