Recall that the trust region step s satisfies $s(\mu) = -(H + \mu I)^{-1} g$, where $(H + \mu I)$ is positive definite. Define $\eta(\mu) = \|s(\mu)\|_2$. Show that

$$\eta'(\mu) = -\frac{s(\mu)^T (H + \mu I)^{-1} s(\mu)}{\eta(\mu)}.$$

(This is one way to back up the claim in the proof of Theorem 3.3.3 that η is a decreasing function.)