EX.1.5.6, Sauer3

If the Secant Method converges to r, $f'(r) \neq 0$, and $f''(r) \neq 0$, then the approximate error relationship $e_{i+1} \approx |f''(r)/(2f'(r))|e_i e_{i-1}$ can be shown to hold. Prove that if in addition $\lim_{i\to\infty} e_{i+1}/e_i^{\alpha}$ exists and is nonzero for some $\alpha > 0$, then $\alpha = (1+\sqrt{5})/2$ and $e_{i+1} \approx |(f''(r)/2f'(r))|^{\alpha-1} e_i^{\alpha}$.