(6) since f has a zero of order m

$\Rightarrow f(z) = (z-z_0)^m h(z)$, $g(z_0) \neq 0$

$\Rightarrow f'(z) = m(z-z_0)^{m-1} h + (z-z_0)^m h(z)$

$\Rightarrow g(z) = \frac{f'}{f} = \frac{hm(z-z_0)^{m-1} + (z-z_0)^m h(z)}{(z-z_0)^m g(z)}$

$= \frac{mh + (z-z_0)h(z)}{(z-z_0)h(z)}$

$= \frac{k(z)}{z-z_0}$, $k(z) = \frac{hm + (z-z_0)h(z)}{g(z)}$

$k(z_0) = \frac{mh}{g(z_0)} = m \neq 0$

k is analyt at z_0

$\therefore \operatorname{Res}(g, z_0) = \lim_{z \to z_0} (z-z_0) g(z)$

$= \lim_{k \to z_0} k(z)$

$= k(z_0)$

$= m$