

Use the residue theorem to evaluate $\oint_C \frac{5z^2 - 3z + 2}{(z-1)^3} dz$, where C is an arbitrary simple closed curve enclosing the point $z = 1$. [88 清大動機 5(a)]

$$[\text{解}] R_1 = \frac{1}{2!} \frac{d^2}{dz^2} \left[(z-1)^3 \cdot \frac{(5z^2 - 3z + 2)}{(z-1)^3} \right] \Bigg|_{z=1} = \frac{1}{2} \cdot 10 = 5$$

$$\therefore \oint_C \frac{5z^2 - 3z + 2}{(z-1)^3} dz = 2\pi i \cdot 5 = 10\pi i$$