

**Exercise 16**Calculate  $y'$ .

$$y = \left( \frac{u-1}{u^2+u+1} \right)^4$$

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**Solution**Calculate  $y'$  by using the chain and quotient rules.

$$\begin{aligned} y' &= \frac{d}{du} \left( \frac{u-1}{u^2+u+1} \right)^4 \\ &= 4 \left( \frac{u-1}{u^2+u+1} \right)^3 \cdot \frac{d}{du} \left( \frac{u-1}{u^2+u+1} \right) \\ &= 4 \left( \frac{u-1}{u^2+u+1} \right)^3 \cdot \frac{\left[ \frac{d}{du}(u-1) \right] (u^2+u+1) - \left[ \frac{d}{du}(u^2+u+1) \right] (u-1)}{(u^2+u+1)^2} \\ &= 4 \left( \frac{u-1}{u^2+u+1} \right)^3 \cdot \frac{(1)(u^2+u+1) - (2u+1)(u-1)}{(u^2+u+1)^2} \\ &= 4 \left( \frac{u-1}{u^2+u+1} \right)^3 \cdot \frac{(u^2+u+1) - (2u^2-u-1)}{(u^2+u+1)^2} \\ &= 4 \frac{(u-1)^3}{(u^2+u+1)^3} \cdot \frac{-u^2+2u+2}{(u^2+u+1)^2} \\ &= \frac{4(u-1)^3(-u^2+2u+2)}{(u^2+u+1)^5} \end{aligned}$$