

$$\begin{aligned} f(t) &= \sqrt{\frac{t}{t^2+3}} = \left(\frac{t}{t^2+3}\right)^{1/2} \Rightarrow \\ f'(t) &= \frac{1}{2} \left(\frac{t}{t^2+3}\right)^{-1/2} \cdot \frac{d}{dt} \left(\frac{t}{t^2+3}\right) = \frac{1}{2} \left(\frac{t^2+3}{t}\right)^{1/2} \cdot \frac{(t^2+3)(1) - t(2t)}{(t^2+3)^2} \\ &= \frac{(t^2+3)^{1/2}}{2t^{1/2}} \cdot \frac{t^2+3-2t^2}{(t^2+3)^2} = \frac{3-t^2}{2t^{1/2}(t^2+3)^{3/2}} \end{aligned}$$