

①

a) $f = r^{-3}$

$$df = -3r^{-4} dr$$

b)
$$\frac{df}{f} = \frac{-3r^{-4} dr}{r^{-3}}$$

$$= -3r^{-1} dr$$

$$= \frac{-3dr}{r} \text{ or } -3\left(\frac{dr}{r}\right)$$

c) Sub $\frac{dr}{r} = -0.04$:

$$\frac{df}{f} = -3(-0.04)$$

$$= 0.12 \text{ or } 12\%$$

②

a) $y = 3 [\cos(x^2+5)]^6$

$$\frac{dy}{dx} = 18 [\cos(x^2+5)]^5 [-\sin(x^2+5) \cdot 2x]$$

$$= -36x \sin(x^2+5) \cos^5(x^2+5)$$

b) $y = \left[\csc \frac{x}{2}\right]^7$

$$\begin{aligned}\frac{dy}{dx} &= 7 \left[\csc \frac{x}{2} \right]^6 \left[-\csc \frac{x}{2} \cot \frac{x}{2} \cdot \frac{1}{2} \right] \\ &= -\frac{7}{2} \csc^7 \frac{x}{2} \cot \frac{x}{2}\end{aligned}$$

c) $y = (6x)(\tan^{-1} x)$ Product Rule

$$\begin{aligned}\frac{dy}{dx} &= 6x \cdot \frac{1}{1+x^2} + (\tan^{-1} x)(6) \\ &= \frac{6x}{1+x^2} + 6 \tan^{-1} x\end{aligned}$$