

Compute the derivatives:

1. $\frac{d}{dx} e^{\frac{1}{x}}.$

Solution: Using the chain rule, we get

$$\begin{aligned}\frac{d}{dx} e^{\frac{1}{x}} &= e^{\frac{1}{x}} \left(-\frac{1}{x^2} \right) \\ &= -\frac{e^{\frac{1}{x}}}{x^2}.\end{aligned}$$

2. $\frac{d}{dx} \frac{\ln(x+2)}{x^2}.$

Solution: Using the quotient rule, we get

$$\frac{d}{dx} \frac{\ln(x+2)}{x^2} = \frac{\frac{x^2}{x+2} - 2x \ln(x+2)}{x^4}.$$

3. $f(x) = \cos(2x)(\sin(x))^2.$

Solution: We have

$$f'(x) = \cos(2x) \cdot 2 \sin(x) \cos(x) - 2 \sin(2x)(\sin(x))^2.$$

4. $f(x) = \cos(\sqrt{1-x^2})$

Solution: We get

$$f'(x) = -\sin(\sqrt{1-x^2}) \cdot \frac{1}{2}(1-x^2)^{-\frac{1}{2}} \cdot (-2x).$$