

Differentiation- HW Problems

1. Determine where $f'(x)$ exists, an expression for it, and where $f'(x)$ is continuous:

$$\begin{aligned} \text{a. } f(x) &= x^3 \sin\left(\frac{1}{x^2}\right) & x \neq 0 \\ &= 0 & x = 0 \end{aligned}$$

$$\begin{aligned} \text{b. } f(x) &= x^4 \sin\left(\frac{1}{x^2}\right) & x \neq 0 \\ &= 0 & x = 0 \end{aligned}$$

$$\begin{aligned} \text{c. } f(x) &= \frac{e^{-\left(\frac{1}{x^2}\right)}}{x} & x \neq 0 & \quad \left(\text{the exponent of } e \text{ is } -\frac{1}{x^2}\right) \\ &= 0 & x = 0 \end{aligned}$$

$$\begin{aligned} \text{d. } f(x) &= |x|^3 & x \in \mathbb{R} & \quad \left(\text{recall: } |x|^3 = x^3 \quad \text{if } x \geq 0 \right. \\ & & & \quad \left. = -x^3 \quad \text{if } x < 0 \right). \end{aligned}$$