

HW 4.5 Find limits using L'Hôpital's Rule

$$\textcircled{1} \lim_{\theta \rightarrow 0} \frac{\sin 5\theta}{\tan 2\theta} \quad \left(\frac{0}{0} \text{ form} \right)$$

$$\begin{aligned} \text{L.R.} &= \lim_{\theta \rightarrow 0} \frac{(\sin 5\theta)'}{(\tan 2\theta)'} = \lim_{\theta \rightarrow 0} \frac{5 \cos 5\theta}{2 \sec^2 2\theta} = \frac{5 \cos 0}{2 \sec^2 0} \\ &= \frac{5}{2} \end{aligned}$$

$$\textcircled{2} \lim_{x \rightarrow 0^+} x \cdot (\ln x)^2 \quad \left(0 \cdot (-\infty)^2 = 0 \cdot \infty \text{ form} \right)$$

$$= \lim_{x \rightarrow 0^+} \frac{(\ln x)^2}{\frac{1}{x}} \quad \left(\frac{\infty}{\infty} \text{ form} \right)$$

$$\begin{aligned} \text{L.R.} &= \lim_{x \rightarrow 0^+} \frac{2 \ln x \cdot \frac{1}{x}}{-\frac{1}{x^2}} = \lim_{x \rightarrow 0^+} \frac{2 \ln x}{-\frac{1}{x}} \quad \left(\frac{-\infty}{-\infty} \text{ form} \right) \end{aligned}$$

$$\begin{aligned} \text{L.R.} &= \lim_{x \rightarrow 0^+} \frac{2 \cdot \frac{1}{x}}{\frac{1}{x^2}} = \lim_{x \rightarrow 0^+} 2x = 2 \cdot 0 = 0 \end{aligned}$$