

Directions: Use L'Hôpital's rule to find the limits. Show and explain your work.

This is a take-home quiz. It is due at the beginning of class on April 9.

$$1. \lim_{x \rightarrow 1} \frac{\ln|x|}{2-2x} = \lim_{x \rightarrow 1} \frac{\frac{1}{x}}{0-2} = \frac{\frac{1}{1}}{-2} = \boxed{-\frac{1}{2}}$$

form $\frac{0}{0}$

$$2. \lim_{x \rightarrow 0} \frac{e^x - x - 1}{x^2} = \lim_{x \rightarrow 0} \frac{e^x - 1}{2x} = \lim_{x \rightarrow 0} \frac{e^x}{2} = \frac{e^0}{2} = \boxed{\frac{1}{2}}$$

form $\frac{0}{0}$

form $\frac{0}{0}$

$$3. \lim_{x \rightarrow \infty} x \left(\tan^{-1}(x) - \frac{\pi}{2} \right) = \lim_{x \rightarrow \infty} \frac{\tan^{-1}(x) - \frac{\pi}{2}}{\frac{1}{x}} = \lim_{x \rightarrow \infty} \frac{\frac{1}{1+x^2}}{\frac{-1}{x^2}} = \lim_{x \rightarrow \infty} \frac{-x^2}{1+x^2} = \boxed{-1}$$

form $\infty \cdot 0$

form $\frac{0}{0}$

$$4. \lim_{x \rightarrow \infty} e^x \sin(e^{-x}) = \lim_{x \rightarrow \infty} \frac{\sin(e^{-x})}{e^{-x}} = \lim_{x \rightarrow \infty} \frac{\cos(e^{-x})(-e^{-x})}{-e^{-x}}$$

form $\infty \cdot 0$

form $\frac{0}{0}$

$$= \lim_{x \rightarrow \infty} \cos(e^{-x})$$

$$= \cos(0) = \boxed{1}$$