

## L'HOPITAL'S RULE

## PRACTICE SET #1

$$1) \text{ Find } \lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2} \quad \left\{ \begin{array}{l} \infty \\ 0 \end{array} \right\} = \lim_{x \rightarrow 0} \frac{\sin x}{2x} \quad \left\{ \begin{array}{l} 0 \\ 0 \end{array} \right\} = \lim_{x \rightarrow 0} \frac{\cos x}{2} = \boxed{\frac{1}{2}}$$

$$2) \text{ Find } \lim_{x \rightarrow \pi} \frac{\csc x}{1 + \cot x} \quad \left\{ \begin{array}{l} \infty \\ 0 \end{array} \right\} = \lim_{x \rightarrow \pi} \frac{-\csc x \cot x}{-\csc^2 x} = \lim_{x \rightarrow \pi} \cot x = \boxed{-1}$$

$$3) \text{ Find } \lim_{x \rightarrow 0^+} x \ln x \quad \left\{ \begin{array}{l} 0 \\ \infty \end{array} \right\} = \lim_{x \rightarrow 0^+} \frac{\ln x}{\frac{1}{x}} \quad \left\{ \begin{array}{l} \infty \\ 0 \end{array} \right\} = \lim_{x \rightarrow 0^+} \frac{\frac{1}{x}}{-\frac{1}{x^2}} = \lim_{x \rightarrow 0^+} -x = \boxed{0}$$

$$4) \text{ Find } \lim_{x \rightarrow 0} \frac{\sin(x^2)}{x} \quad \left\{ \begin{array}{l} 0 \\ 0 \end{array} \right\} = \lim_{x \rightarrow 0} \frac{2x \cos(2x)}{1} = \boxed{0}$$

$$5) \text{ Find } \lim_{x \rightarrow \frac{\pi}{2}^-} (\frac{\pi}{2} - x) \tan x \quad \left\{ \begin{array}{l} 0 \\ \infty \end{array} \right\} = \lim_{x \rightarrow \frac{\pi}{2}^-} \frac{\frac{\pi}{2} - x}{\cot x} \quad \left\{ \begin{array}{l} 0 \\ 0 \end{array} \right\} = \lim_{x \rightarrow \frac{\pi}{2}^-} \frac{-1}{-\csc^2 x} = \boxed{1}$$

$$6) \text{ Find } \lim_{x \rightarrow 1} \frac{x^3 - 1}{4x^3 - x - 3} \quad \left\{ \begin{array}{l} \infty \\ 0 \end{array} \right\} = \lim_{x \rightarrow 1} \frac{3x^2}{12x^2 - 1} = \boxed{\frac{3}{11}}$$

$$7) \text{ Find } \lim_{x \rightarrow \infty} \frac{\log_2 x}{\log_2(x+3)} \quad \left\{ \begin{array}{l} \infty \\ 0 \end{array} \right\} = \lim_{x \rightarrow \infty} \frac{\frac{\ln x}{\ln 2}}{\frac{\ln(x+3)}{\ln 2}} = \lim_{x \rightarrow \infty} \frac{\ln x}{\ln(x+3)} = \lim_{x \rightarrow \infty} \frac{\frac{1}{x}}{\frac{1}{x+3}} = \lim_{x \rightarrow \infty} \frac{x+3}{x}$$

$$* 8) \text{ Find } \lim_{x \rightarrow \infty} \frac{3x - 5}{2x^2 - x + 2} = \boxed{0}$$

$$\left\{ \begin{array}{l} \infty \\ 0 \end{array} \right\} = \lim_{x \rightarrow \infty} \frac{1}{x}$$

$$* 9) \text{ Find } \lim_{x \rightarrow \infty} \frac{4x^3 - 2x^2 + 5}{3x^3 - x} = \boxed{\frac{4}{3}}$$

$$= \lim_{x \rightarrow \infty} 1$$

$$* 10) \text{ Find } \lim_{x \rightarrow \infty} \frac{3x^2 + 1}{5x} = \boxed{\infty}$$

$$= \boxed{1}$$

● GREEN → NON CALCULUS SIMPLIFICATION  
 ● BLUE → RESULT FROM AFTER DERIVATIVE

\* CAN DO WITHOUT L'HOPITAL'S RULE