L'HÔPITAL'S RULE   PRACTICE SET # 1

1) Find $\lim_{x\to 0} \frac{1-\cos x}{x^2} \overset{\{\frac{0}{0}\}}{=} \lim_{x\to 0} \frac{\sin x}{2x} \overset{\{\frac{0}{0}\}}{=} \lim_{x\to 0} \frac{\cos x}{2} = \boxed{\frac{1}{2}}$

2) Find $\lim_{x\to \pi} \frac{\csc x}{1+\cot x} \overset{\{\frac{\infty}{\infty}\}}{=} \lim_{x\to\pi} \frac{-\csc x \cot x}{-\csc^2 x} = \lim_{x\to\pi} \cos x = \boxed{-1}$

3) Find $\lim_{x\to 0^+} x\ln x$ $-\{0\cdot\infty\}$ $= \lim_{x\to 0^+} \frac{\ln x}{\frac{1}{x}} \overset{\{\frac{\infty}{\infty}\}}{=} \lim_{x\to 0^+} \frac{\frac{1}{x}}{\frac{-1}{x^2}} = \lim_{x\to 0^+} -x = \boxed{0}$

4) Find $\lim_{x\to 0} \frac{\sin(x^2)}{x} \overset{\{\frac{0}{0}\}}{=} \lim_{x\to 0} \frac{2x\cos(2x)}{1} = \boxed{0}$

5) Find $\lim_{x\to \pi/2} \left(\frac{\pi}{2}-x\right)\tan x \overset{\{0\cdot\infty\}}{=} \lim_{x\to\pi/2} \frac{\frac{\pi}{2}-x}{\cot x} \overset{\{\frac{0}{0}\}}{=} \lim_{x\to\pi/2} \frac{-1}{-\csc^2 x} = \boxed{1}$

6) Find $\lim_{x\to 1} \frac{x^3-1}{4x^3-x-3} \overset{\{\frac{0}{0}\}}{=} \lim_{x\to 1} \frac{3x^2}{12x^2-1} = \boxed{\frac{3}{11}}$

7) Find $\lim_{x\to\infty} \frac{\log_2 x}{\log_2(x+3)} = \lim_{x\to\infty} \frac{\frac{\ln x}{\ln 2}}{\frac{\ln(x+3)}{\ln 2}} = \lim_{x\to\infty} \frac{\ln x}{\ln(x+3)} \overset{\{\frac{\infty}{\infty}\}}{=} \lim_{x\to\infty} \frac{\frac{1}{x}}{\frac{1}{x+3}}$

$= \lim_{x\to\infty} \frac{x+3}{x} \overset{\{\frac{\infty}{\infty}\}}{=} \lim_{x\to\infty} \frac{1}{1} = \lim_{x\to\infty} 1 = \boxed{1}$

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

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

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

● GREEN → NON CALCULUS SIMPLIFICATION

● BLUE → RESULT FROM AFTER DERIVATIVE

* CAN DO WITHOUT L'HOPITAL'S RULE