

$$1. \lim_{x \rightarrow 0} \frac{3x^2}{\cos(x) - 1} = \lim_{x \rightarrow 0} \frac{6x}{-\sin(x)} = \lim_{x \rightarrow 0} \frac{6}{-\cos(x)} = \frac{6}{-\cos(0)} = \boxed{-6}$$

form  $\frac{0}{0}$

form  $\frac{0}{0}$

$$2. \lim_{x \rightarrow \infty} x \sin\left(\frac{4}{3x}\right) = \lim_{x \rightarrow \infty} \frac{\sin\left(\frac{4}{3x}\right)}{\frac{1}{x}} = \lim_{x \rightarrow \infty} \frac{\cos\left(\frac{4}{3x}\right)\left(-\frac{4}{3x^2}\right)}{-\frac{1}{x^2}}$$

$$= \lim_{x \rightarrow \infty} \frac{4}{3} \cos\left(\frac{4}{3x}\right) = \frac{4}{3} \cos(0)$$

$$= \boxed{\frac{4}{3}}$$

form  $\infty \cdot 0$

form  $\frac{0}{0}$

$$3. \lim_{x \rightarrow \infty} \frac{2x^2 + 7e^x}{x^2 + x + 4e^x - 1} = \lim_{x \rightarrow \infty} \frac{4x + 7e^x}{2x + 1 + 4e^x} = \lim_{x \rightarrow \infty} \frac{4 + 7e^x}{2 + 4e^x} = \lim_{x \rightarrow \infty} \frac{7e^x}{4e^x}$$

form  $\frac{\infty}{\infty}$

form  $\frac{\infty}{\infty}$

form  $\frac{\infty}{\infty}$

$= \boxed{\frac{7}{4}}$

$$4. \lim_{x \rightarrow 0} (\ln|x| - \ln|\sin(x)|) = \lim_{x \rightarrow 0} \ln \left| \frac{x}{\sin(x)} \right| = \ln \left| \lim_{x \rightarrow 0} \frac{x}{\sin(x)} \right|$$

form  $\infty - \infty$

form  $\frac{0}{0}$

$$= \ln \left| \lim_{x \rightarrow 0} \frac{1}{\cos(x)} \right|$$

$$= \ln \left| \frac{1}{\cos(0)} \right| = \ln|1| = \boxed{0}$$

1.  $\lim_{x \rightarrow 0} \left( \frac{1}{x} - \frac{1}{x^2} \right) = \lim_{x \rightarrow 0} \left( \frac{x}{x^2} - \frac{1}{x^2} \right) = \lim_{x \rightarrow 0} \frac{x-1}{x^2} = \boxed{-\infty}$

*(Approaching -1)*  
*(Approaching 0, pos.)*

form  $\infty - \infty$

2.  $\lim_{x \rightarrow 1} \frac{4 + 2 \ln|x-1|}{x - 3 \ln|1-x|} = \lim_{x \rightarrow 1} \frac{\frac{2}{x-1}}{\frac{-3}{1-x}} = \lim_{x \rightarrow 1} \frac{-2}{(x-1)^2} = \lim_{x \rightarrow 1} \frac{2(x-1)^2}{3(1-x)^2}$

form  $\frac{\infty}{\infty}$     form  $\frac{\infty}{\infty}$

$= \lim_{x \rightarrow 1} \frac{2}{3} \left( \frac{x-1}{1-x} \right)^2 = \lim_{x \rightarrow 1} \frac{2}{3} (-1)^2$

$= \lim_{x \rightarrow 1} \frac{2}{3} = \boxed{\frac{2}{3}}$

3.  $\lim_{x \rightarrow \infty} x(e^{1/x} - 1) = \lim_{x \rightarrow \infty} \frac{e^{1/x} - 1}{1/x}$

form  $\infty \cdot 0$     form  $\frac{0}{0}$

$= \lim_{x \rightarrow \infty} \frac{e^{1/x} \left( -\frac{1}{x^2} \right)}{-\frac{1}{x^2}} = \lim_{x \rightarrow \infty} e^{1/x}$

$= e^0 = \boxed{1}$

4.  $\lim_{x \rightarrow 0} \frac{x^2}{\ln|\sec x|} = \lim_{x \rightarrow 0} \frac{2x}{\frac{\sec(x)\tan(x)}{\sec(x)}} = \lim_{x \rightarrow 0} \frac{2x}{\tan(x)}$

form  $\frac{0}{0}$     still  $\frac{0}{0}$

$= \lim_{x \rightarrow 0} \frac{2}{\sec^2(x)} = \frac{2}{\sec^2(0)} = \frac{2}{1} = \boxed{2}$