1. $\lim\limits_{x \to 0} \dfrac{3x^2}{\cos(x) - 1} = \lim\limits_{x \to 0} \dfrac{6x}{-\sin(x)} = \lim\limits_{x \to 0} \dfrac{6}{-\cos(x)} = \dfrac{6}{-\cos(0)} = \boxed{-6}$

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

2. $\lim\limits_{x \to \infty} x\sin\left(\dfrac{4}{3x}\right) = \lim\limits_{x \to \infty} \dfrac{\sin\left(\frac{4}{3x}\right)}{\frac{1}{x}} = \lim\limits_{x \to \infty} \dfrac{\cos\left(\frac{4}{3x}\right)\left(-\frac{4}{3x^2}\right)}{\frac{-1}{x^2}}$

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

$= \lim\limits_{x \to \infty} \dfrac{4}{3}\cos\left(\dfrac{4}{3x}\right) = \dfrac{4}{3}\cos(0)$

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

3. $\lim\limits_{x \to \infty} \dfrac{2x^2 + 7e^x}{x^2 + x + 4e^x - 1} = \lim\limits_{x \to \infty} \dfrac{4x + 7e^x}{2x + 1 + 4e^x} = \lim\limits_{x \to \infty} \dfrac{4 + 7e^x}{2 + 4e^x} = \lim\limits_{x \to \infty} \dfrac{7e^x}{4e^x}$

form $\frac{\infty}{\infty}$ form $\frac{\infty}{\infty}$ form $\frac{\infty}{\infty}$ $= \boxed{\dfrac{7}{4}}$

4. $\lim\limits_{x \to 0} \left(\ln|x| - \ln|\sin(x)| \right) = \lim\limits_{x \to 0} \ln\left| \dfrac{x}{\sin(x)} \right| = \ln\left| \lim\limits_{x \to 0} \dfrac{x}{\sin(x)} \right|$

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

$= \ln\left| \lim\limits_{x \to 0} \dfrac{1}{\cos(x)} \right|$

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

1. $\lim\limits_{x\to 0}\left(\dfrac{1}{x}-\dfrac{1}{x^2}\right) = \lim\limits_{x\to 0}\left(\dfrac{x}{x^2}-\dfrac{1}{x^2}\right) = \lim\limits_{x\to 0}\dfrac{x-1}{x^2} = \boxed{-\infty}$

(approaching -1)

(approaching 0 pos.)

form $\infty-\infty$

2. $\lim\limits_{x\to 1}\dfrac{4+2\ln|x-1|}{x-3\ln|1-x|} = \lim\limits_{x\to 1}\dfrac{\frac{2}{x-1}}{1-\frac{-3}{1-x}} = \lim\limits_{x\to 1}\dfrac{\frac{-2}{(x-1)^2}}{-\frac{3(-1)}{(1-x)^2}} = \lim\limits_{x\to 1}\dfrac{-2}{3}\dfrac{(x-1)^2}{(1-x)^2}$

form $\dfrac{\infty}{\infty}$ form $\dfrac{\infty}{\infty}$

$= \lim\limits_{x\to 1}\dfrac{-2}{3}\left(\dfrac{x-1}{1-x}\right)^2 = \lim\limits_{x\to 1}\dfrac{-2}{3}(-1)^2$

$= \lim\limits_{x\to 1}\dfrac{-2}{3} = \boxed{\dfrac{-2}{3}}$

3. $\lim\limits_{x\to\infty}x(e^{1/x}-1) = \lim\limits_{x\to\infty}\dfrac{e^{\frac{1}{x}}-1}{\frac{1}{x}}$

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

$= \lim\limits_{x\to\infty}\dfrac{e^{\frac{1}{x}}\left(\frac{-1}{x^2}\right)}{\frac{-1}{x^2}} = \lim\limits_{x\to\infty}e^{\frac{1}{x}}$

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

4. $\lim\limits_{x\to 0}\dfrac{x^2}{\ln|\sec x|} = \lim\limits_{x\to 0}\dfrac{2x}{\frac{\sec(x)\tan(x)}{\sec(x)}} = \lim\limits_{x\to 0}\dfrac{2x}{\tan(x)}$

still $\dfrac{0}{0}$

form $\dfrac{0}{0}$

$= \lim\limits_{x\to 0}\dfrac{2}{\sec^2(x)} = \dfrac{2}{\sec^2(0)} = \dfrac{2}{1} = \boxed{2}$