Solutions:

$$(1)\ \lim_{x\to 1} \frac{3x^2-10x+8}{5x^2-9x+4} = \lim_{x\to 1} \frac{(3x-4)(x-2)}{(5x-4)(x-1)} = \frac{(-1)(-1)}{(+1)\ (0)}$$

Hence, $\displaystyle\lim_{x\to 1^+} \frac{3x^2-10x+8}{5x^2-9x+4} = \frac{(-1)(-1)}{(+1)\ (0^+)} = +\infty$

$(x>1 \Rightarrow x-1>0)$

$\neq$

$\displaystyle\lim_{x\to 1^-} \frac{3x^2-10x+8}{5x^2-9x+4} = \frac{(-1)(-1)}{(+1)\ (0^-)} = -\infty$

$\left(\begin{matrix} x<1 \\ x-1<0 \end{matrix}\right)$

$\displaystyle\lim_{x\to 1} \frac{3x^2-10x+8}{5x^2-9x+4} = \text{DNE}$

$$(2)\ \lim_{x\to 1} \sin\left(\frac{\pi(x^2-1)}{4x-4}\right) = \sin\left(\lim_{x\to 1}\left(\frac{\pi\,\cancel{(x-1)}(x+1)}{4\cancel{(x-1)}}\right)\right) = \sin\left(\frac{2\pi}{4}\right) = \frac{\sqrt{2}}{2}$$

$$(5)\ \lim_{x\to \frac{\pi}{2}} (\tan x - \sec x) = \lim_{x\to\frac{\pi}{2}}\left(\frac{\sin x}{\cos x} - \frac{1}{\cos x}\right) = \lim_{x\to\pi/2} \frac{\sin x - 1}{\cos x}\cdot\frac{\sin x+1}{\sin x+1}$$

$$= \lim_{x\to\pi/2} \frac{\sin^2 x - 1}{(\cos x)(\sin x+1)} = \lim_{x\to\pi/2} \frac{-\cos^2 x}{(\cos x)(\sin x+1)} = \lim_{x\to\pi/2} \frac{-\cos x}{\sin x+1} = \frac{-0}{2} = 0$$

$$(10)\ \lim_{x\to 0^+} \frac{|x|-x}{\sqrt[3]{x}} = \lim_{x\to 0^+} \frac{x-x}{\sqrt[3]{x}} = \lim_{x\to 0^+} \frac{0}{\sqrt[3]{x}} = \lim_{x\to 0^+} 0 = 0$$

$$\lim_{x\to 0^-} \frac{|x|-x}{\sqrt[3]{x}} = \lim_{x\to 0^-} \frac{-x-x}{\sqrt[3]{x}} = \lim_{x\to 0^-} \frac{-2x}{\sqrt[3]{x}} = \lim_{x\to 0^-} \frac{-2(\sqrt[3]{x})^3}{\sqrt[3]{x}} = \lim_{x\to 0^-} \frac{-2(\sqrt[3]{x})^2}{1} = 0$$

Hence $\displaystyle\lim_{x\to 0} \frac{|x|-x}{\sqrt[3]{x}} = 0$

(13) $\lim_{x\to 0^+} \frac{x}{\sqrt{1-\cos x}} = \lim_{x\to 0^+} \frac{x\sqrt{1+\cos x}}{\sqrt{1-\cos x}\sqrt{1+\cos x}} = \lim_{x\to 0^+} \frac{x\sqrt{1+\cos x}}{\sqrt{1-\cos^2 x}}$

$$= \lim_{x\to 0} \frac{x\sqrt{1+\cos x}}{\sqrt{\sin^2 x}} = \lim_{x\to 0} \frac{x\sqrt{1+\cos x}}{|\sin x|} = \begin{cases} \frac{x\sqrt{1+\cos x}}{\sin x} & \text{if } x\to 0^+ \\ \frac{x\sqrt{1+\sin x}}{-\sin x} & \text{if } x\to 0^- \end{cases}$$

$(\sqrt{u^2} = |u|)$

$$= \begin{cases} \left(\frac{x}{\sin x}\right)\left(\sqrt{1+\cos x}\right) & \text{if } x\to 0^+ \\ \left(\frac{x}{\sin x}\right)\left(-\sqrt{1+\cos x}\right) & \text{if } x\to 0^- \end{cases} = \begin{cases} 1\cdot\sqrt{2} & \text{if } x\to 0^+ \\ 1\cdot(-\sqrt{2}) & \text{if } x\to 0^- \end{cases}$$

$$\therefore \left(\lim_{x\to 0^+} \frac{x}{\sqrt{1-\cos x}} = \sqrt{2}\right) \neq \left(\lim_{x\to 0^-} \frac{x}{\sqrt{1-\cos x}} = -\sqrt{2}\right)$$

Hence limit DNE.

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(16)(a) Plug-in

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(16)(b)

DON'T WORRY ABOUT THIS ONE AND (17)(i)**