1 a. $\lim_{x \to \pi/2} \left[\frac{(x^2 - \pi/4) \cdot \sin(\cos x)}{x - \pi/2} \right]$

Since the above will give an undefined answer, L'Hôpital's rule is used:

$\lim_{x \to \pi/2} \left(\frac{d}{dx} \left[(x^2 - \pi/4) \sin(\cos x) \right] \right)$

Numerator: $\underset{u}{(x^2 - \pi/4)} \underset{v}{(\sin(\cos x))}$

$du/dx = 2x$ $\qquad dv/dx = \cos(-\sin x)$

$\therefore \frac{d}{dx}(x^2 - \pi/4)(\sin(\cos x)) = (x^2 - \pi/4)\cos(-\sin x) + 2x(\sin(\cos x))$

Denominator: $\pi - \pi/2$

$\frac{d}{dx}(x - \pi/2) = 1$

$\therefore \lim_{x \to \pi/2} \left[\frac{(x^2 - \pi/4)\sin(\cos x)}{x - \pi/2} \right] = \lim_{x \to \pi/2} \left[\frac{(x^2 - \pi/4)\cos(-\sin x) + 2x(\sin(\cos x))}{1} \right]$

$= \left(\frac{\pi}{2}\right)^2 - \pi/4 \cos(-\sin 90) + 2x(\sin(\cos 90))$

$= \frac{\pi^2}{4} - \pi/4 \times 1 + 2x \times 0$

$= \frac{\pi^2}{4} - \pi/4 \quad = \frac{\pi^2 - \pi}{4}$

$= \frac{180^2 - 180}{4} \quad = 8055.$

b. $\lim_{x \to \pi/2} \ln \left[\exp \frac{(3x^2 + 2x - 1)}{x + 1} \right]$

$= \lim_{x \to \pi/2} \left[\frac{3x^2 + 2x - 1}{x + 1} \right]$

$= \lim_{x \to \pi/2} \left[\frac{(3x^2 + 3x)(-x - 1)}{x + 1} \right]$

$= \lim_{x \to \pi/2} \frac{(3x - 1)\cancel{(x + 1)}}{\cancel{x + 1}}$

$= \lim_{x \to \pi/2} 3x - 1$

$= 3(\pi/2) - 1$

$= 3/2 \times 22/7 - 1$

$= 66/14 - 1 \quad = 26/7$