Compute the following limits, with explanation:

- $\lim_{x\to\infty} \frac{x}{\ln(x)}$

$\lim_{x\to\infty} \frac{\frac{d}{dx}(x)}{\frac{d}{dx}(\ln(x))}$ $\lim_{x\to\infty} \frac{1}{\frac{1}{x}}$ $\lim_{x\to\infty} (x)$ ✓ ∞

- $\lim_{x\to 0} \frac{2x+1}{x-1}$?

$\frac{2(0)+1}{0-1}$ -1 ✓

- $\lim_{x\to\infty} \frac{\tan^{-1}(x)}{x^2+1}$

~~$\lim_{x\to\infty} \frac{\frac{d}{dx}(\arctan(x))}{\frac{d}{dx}(x^2+1)}$~~

$\lim_{x\to\infty} (\arctan(x)) = \frac{\pi}{2}$

$\lim_{x\to\infty} (x^2+1) = \infty$

0 ✓

- $\lim_{x\to 0} \frac{4x+1}{x}$?

ONE ✓

- $\lim_{x\to 0} \frac{2x}{x}$?

$\lim_{x\to 0} \frac{\frac{d}{dx}(2x)}{\frac{d}{dx}(x)}$ Use algebra! $\frac{2x}{x} = 2$

$\lim_{x\to 0} 2$

$\lim_{x\to 0} \frac{2}{1}$ 2 ✓

Compute the following limits, with explanation:

- $\lim_{x\to\infty} \frac{x}{\ln(x)}$ $= \lim_{x\to\infty} \frac{1}{\frac{1}{x}} = \lim_{x\to\infty} x = \infty$ ✓

- $\lim_{x\to 0} \frac{2x+1}{x-1}$? $= \lim_{x\to 0} \frac{x(2+\frac{1}{x})}{x(1-\frac{1}{x})} = \lim_{x\to 0} \frac{2+\frac{1}{x}}{1-\frac{1}{x}} = \lim_{x\to 0} \frac{-\frac{1}{x^2}}{\frac{1}{x^2}} = \lim_{x\to 0} -1 = -1$ ✓

I love it! But That's the hard way....

- $\lim_{x\to\infty} \frac{\tan^{-1}(x)}{x^2+1}$ $= \lim_{x\to\infty} \frac{\frac{\pi}{2}}{\infty} = 0$

every time you have a fixed # / infinity $= 0$ ✓

- $\lim_{x\to 0} \frac{4x+1}{x}$? $\cancel{=} \lim_{x\to 0} \frac{4x}{x} = 4$ DNE

$-\frac{1}{2}$ ✓

- $\lim_{x\to 0} \frac{2x}{x}$? $= 2$ ✓

- $\lim_{x\to-\infty} \frac{x-1}{x+1}$? $= \lim_{x\to\infty} \frac{1-\frac{1}{x}}{1+\frac{1}{x}} = \frac{1-0}{1+0} = 1$ ✓

- $\lim_{x\to\infty} \frac{x^2}{x}$? $= x$

  limit?

  $-1/2$

  ∞

- $\lim_{x\to 1} \frac{x^2-3x+2}{\sin(x-1)}$ $= \lim_{x\to 1} \frac{2x-3}{\cos(x-1)} = \lim_{x\to 1} \frac{2(1)-3}{\cos(1-1)} = \frac{2-3}{\cos(0)} = \frac{-1}{1} = -1$ ✓

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

  good ✓

- $\lim_{x\to 0^+} x\ln(x)$ $= \lim_{x\to 0} \frac{\ln(x)}{\frac{1}{x}} = \lim_{x\to 0} \frac{\frac{1}{x}}{-\frac{1}{x^2}} = \lim_{x\to 0} -x = 0$ ✓

- $\lim_{x\to-\infty} \frac{x-1}{x+1}$?

$$\lim_{x\to-\infty} \frac{\frac{d}{dx}(x-1)}{\frac{d}{dx}(x+1)} \quad \lim_{x\to\infty}\left(\frac{1}{1}\right) \quad 1$$

- $\lim_{x\to\infty} \frac{x^2}{x}$?

$$\lim_{x\to\infty} \frac{\frac{d}{dx}(x^2)}{\frac{d}{dx}(x)} \quad \lim_{x\to\infty}\left(\frac{2x}{1}\right) \quad \infty$$

- $\lim_{x\to1} \frac{x^2-3x+2}{\sin(x-1)}$

$$\lim_{x\to1} \frac{\frac{d}{dx}(x^2-3x+2)}{\frac{d}{dx}(\sin(x-1))} \quad \lim_{x\to1} \frac{2x-3}{\cos(x-1)} \quad \frac{2(1)-3}{\cos(1-1)} = -1$$

- $\lim_{x\to0} \frac{1-\cos(x)}{x^2}$

$$\lim_{x\to0} \frac{\frac{d}{dx}(1-\cos(x))}{\frac{d}{dx}(x^2)} \quad \lim_{x\to0} \frac{\sin(x)}{2x} \quad \lim_{x\to0} \frac{\frac{d}{dx}(\sin(x))}{\frac{d}{dx}(2x)}$$

$$\lim_{x\to0} \frac{\cos(x)}{2} \quad \frac{1}{2}$$

- $\lim_{x\to0^+} x\ln(x)$

$$\lim_{x\to0^+} \frac{\ln(x)}{\frac{1}{x}}$$

$$\lim_{x\to0^+} \frac{\frac{d}{dx}(\ln(x))}{\frac{d}{dx}\left(\frac{1}{x}\right)} \quad \lim_{x\to0^+} \frac{\frac{1}{x}}{-\frac{1}{x^2}} \quad \lim_{x\to0^+}(-x) \quad 0$$