$y = x^{\sin x}$ Find $\frac{dy}{dx}$

$\ln y = \ln\left(x^{\sin x}\right) = \sin x \ln x$

$$\boxed{\frac{d}{dx}(\sin x)\ \frac{d}{dx}(\ln x)}$$

$f(x) = \ln(\cos(e^x))$ Find $f'(x)$.

$f'(x) = \frac{1}{\cos(e^x)} \frac{d}{dx}(\cos(e^x))$

$= \frac{-\sin(e^x)}{\cos(e^x)} \frac{d}{dx}(e^x) = \boxed{-e^x \tan(e^x)}$

L'Hospital Rule:

$\lim_{x\to 0} \frac{\sin x}{x}$ ($\frac{0}{0}$ form) $\boxed{\frac{0}{0}}$ $\boxed{\frac{\infty}{\infty}}$

$= \lim_{x\to 0} \frac{\cos x}{1} = \cos 0 = 1$

$$\boxed{\lim_{x\to a} \frac{f(x)}{g(x)} = \lim_{x\to a} \frac{f'(x)}{g'(x)}} = \lim_{x\to a} \frac{f''(x)}{g''(x)}$$

$\lim_{x\to 0^+} \frac{\ln x}{\csc x}$ ($\frac{\infty}{\infty}$ form)

$= \boxed{\lim_{x\to 0^+} \frac{-1/x^2}{-\csc x \cot x}}$ ($\frac{\infty}{\infty}$ form) $= \lim_{x\to 0^+} \frac{-1}{x \csc x \cot x} = \lim_{x\to 0^+} \frac{-\sin x}{x \cot x} = \lim_{x\to 0^+} \frac{\sin x}{x} \lim_{x\to 0^+} \frac{-1}{\cot x}$

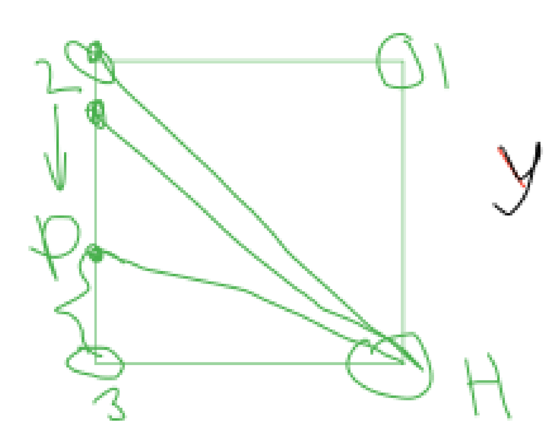
$= 1 \cdot \lim_{x\to 0^+}(-\tan x) = 1 \cdot 0 = 0$

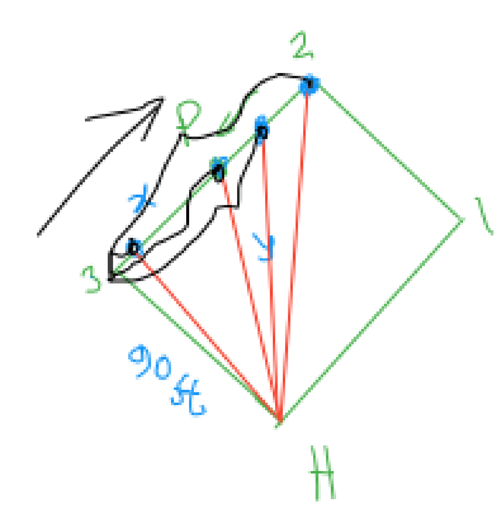
$x^2 + 90^2 = y^2$

$2x \frac{dx}{dt} = 2y \frac{dy}{dt}$

$\Rightarrow \frac{dy}{dt} = \frac{x}{y} \frac{dx}{dt}$

$\frac{dx}{dt} = -30$ ft/

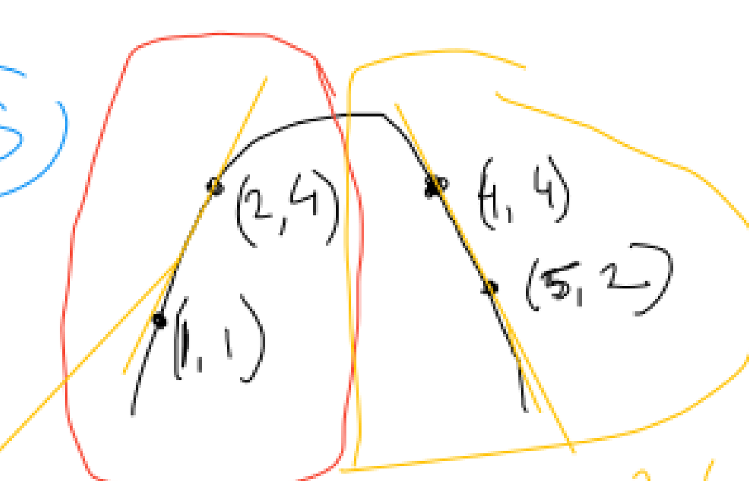




x

30 ft/s

20 ft



$\frac{4-1}{2-1} = 3 > 0$

$\frac{2-4}{5-4} = -2 < 0$