December 8, 2022

Semester Renew Day 2

Find $\frac{dy}{dx}$.

$$e^{2x}\ln(2y) + 4x^3 = 9 - 7y^2$$

$$e^{2x}\cdot\frac{1}{2y}\cdot 2\cdot\frac{dy}{dx} + \ln(2y)\cdot e^{2x}\cdot 2 + 12x^2 = -14y\frac{dy}{dx}$$

$$\frac{e^{2x}}{y}\frac{dy}{dx} + 2e^{2x}\ln(2y) + 12x^2 = -14y\frac{dy}{dx}$$

$$2e^{2x}\ln(2y) + 12x^2 = \left(-\frac{e^{2x}}{y} - \frac{14y^2}{y}\right)\frac{dy}{dx}$$

$$\frac{y}{-e^{2x}-14y^2}\left(2e^{2x}\ln(2y) + 12x^2\right) = \left(-\frac{e^{2x}}{y} - \frac{14y^2}{y}\right)\frac{dy}{dx}$$

$$\frac{y\left(2e^{2x}\ln(2y) + 12x^2\right)}{-e^{2x}-14y^2} = \frac{dy}{dx}$$

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Related Rates

$\frac{d}{dt}\left[V = \frac{2}{3}\pi r^3\right]$

$\frac{dV}{dt} = 2\pi r^2 \frac{dr}{dt}$

$72\pi = 2\pi(3)^2 \frac{dr}{dt}$

$\frac{72\pi}{18\pi} = \frac{18\pi}{18\pi}\frac{dr}{dt}$

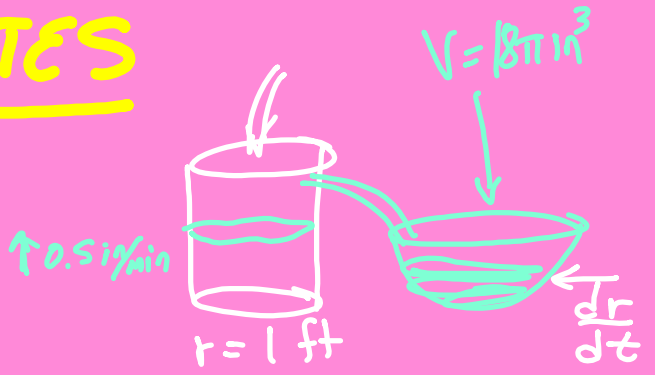
$4 \frac{in}{min} = dr/dt$

$V = \frac{2}{3}\pi r^3$

$\frac{3}{2}\cdot 18\pi = \frac{2}{3}\pi r^3$

$\sqrt[3]{27} = \sqrt[3]{r^3}$

$3 = r$



$V = \pi r^2 h$

$V = \pi(12)^2 h$

$\frac{d}{dt}\left[V = 144\pi h\right]$

$\frac{dV}{dt} = 144\pi \frac{dh}{dt}$

$\frac{dV}{dt} = 144\pi(0.5)$

$= 72\pi \frac{in^3}{min}$

L'Hopital's

$$\lim_{x\to 0^+} \sin x^{\tan x} = 0^0$$

$$\ln(\sin x)^{\tan x}$$

$$\lim_{x\to 0^+} e^{\tan x \cdot \ln(\sin x)}$$

$$\lim_{x\to 0^+} \tan x \cdot \ln(\sin x)$$

$$\lim_{x\to 0^+} \frac{\ln(\sin x)}{\cot x} = \frac{-\infty}{\infty}$$

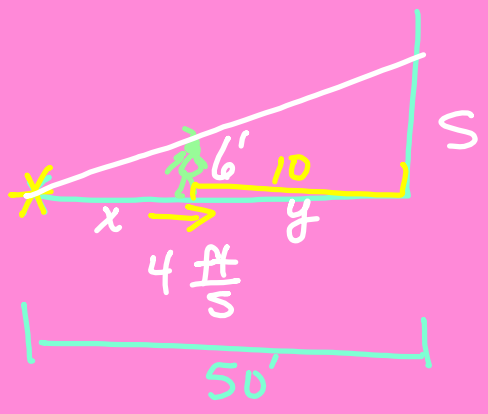
$$\lim_{x\to 0^+} \frac{\frac{1}{\sin x}\cdot \cos x}{-\csc^2 x}$$

$$\lim_{x\to 0^+} \frac{\frac{\cos x}{\sin x}}{\frac{-1}{\sin^2 x}} \cdot \frac{-\sin^2 x}{1}$$

$$= 1 \cdot 0$$

$$= 0$$

$e^0 = 1$



How fast is the height of shadow decreasing when the grinch is 10 ft. from wall?

$$\frac{6}{x} = \frac{s}{50} \qquad \frac{6}{40} = \frac{s}{50}$$

$$\frac{d}{dt}[xs = 300] \qquad \frac{40s}{40} = \frac{300}{40} = 7.5$$

$$x \cdot \frac{ds}{dt} + s \cdot \frac{dx}{dt} = 0$$

$$40 \cdot \frac{ds}{dt} + (7.5)(4) = 0$$

$$40\frac{ds}{dt} + 30 = 0$$

$$\frac{ds}{dt} = -\frac{30}{40}$$

$-3/4$ ft/s

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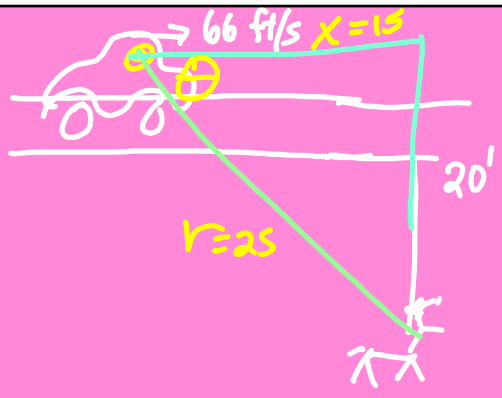
#6



$\tan\theta = \frac{20}{x}$ $\quad 20x^{-1}$

$\sec^2\theta \frac{d\theta}{dt} = \frac{-20}{x^2}\frac{dx}{dt}$

$\left(\frac{25}{15}\right)^2 \frac{d\theta}{dt} = \frac{-20}{(15)^2} \cdot -66$

$\frac{625}{225}\frac{d\theta}{dt} = \frac{1320}{225}\frac{225}{625}$

$\frac{d\theta}{dt} = \frac{1320}{625}\ \frac{\text{rad}}{\text{sec}}$

$= \frac{264}{125}$

$r = 25$

$x^2 + 20^2 = 25^2$

$x^2 + 400 = 625$

$\sqrt{x^2} = \sqrt{225}$

$x = 15$