$$\frac{e^y}{\tan x} = x^3 y^2$$

$$\frac{\tan x \cdot e^y \frac{dy}{dx} - e^y \cdot \sec^2 x}{\tan^2 x} = x^3 \cdot 2y \frac{dy}{dx} + y^2 \cdot 3x^2$$

$$e^y \tan x \frac{dy}{dx} - e^y \sec^2 x = 2x^3 y \tan^2 x \frac{dy}{dx} + 3x^2 y^2 \tan^2 x$$

$$e^y \tan x \frac{dy}{dx} - 2x^3 y \tan^2 x \frac{dy}{dx} = 3x^2 y^2 \tan^2 x + e^y \sec^2 x$$

$$\frac{dy}{dx} = \frac{3x^2 y^2 \tan^2 x + e^y \sec^2 x}{e^y \tan x - 2x^3 y \tan^2 x}$$

12:5 $\frac{d}{dx}\left(\frac{(x+1)^2}{\sqrt{x^2+1}}\right)$

$$y = \frac{(x+1)^2}{\sqrt{x^2+1}}$$

$$\ln y = \ln\left(\frac{(x+1)^2}{\sqrt{x^2+1}}\right)$$

$$\ln y = \ln (x+1)^2 - \ln (x^2+1)^{\frac{1}{2}}$$

$$\ln y = 2\ln(x+1) - \frac{1}{2}\ln(x^2+1)$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{2}{x+1} - \frac{1}{2} \cdot \frac{1}{x^2+1} \cdot 2x$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{2}{x+1} - \frac{x}{x^2+1}$$

$$\frac{dy}{dx} = \frac{(x+1)^2}{\sqrt{x^2+1}}\left[\frac{2}{x+1} - \frac{x}{x^2+1}\right]$$

13:3 $\quad h(t) = -5t^2+4t+2$

reach peak @ $t=?$

$$v(t) = h'(t) = -10t+4$$

$$0 = -10t+4$$

$$10t = 4$$

$$t = \frac{2}{5} \text{ sec}$$

height @ peak?

$$h\left(\frac{2}{5}\right) = -5\left(\frac{2}{5}\right)^2 + 4\left(\frac{2}{5}\right) + 2$$

$$= -\cancel{5}\cdot\frac{4}{\cancel{25}\ 5} + \frac{8}{5} + \frac{10}{5}$$

$$= -\frac{4}{5} + \frac{8}{5} + \frac{10}{5} = \frac{14}{5} \text{ length}$$

18:1 $\quad s(t) = 8t^2+64t+6$

$$v(t) = s'(t) = 16t+64$$

total distance between $t=-8$ and $t=0$

$$s(-8) = 6$$

$$s(0) = 6$$

$$0 = 16t+64$$

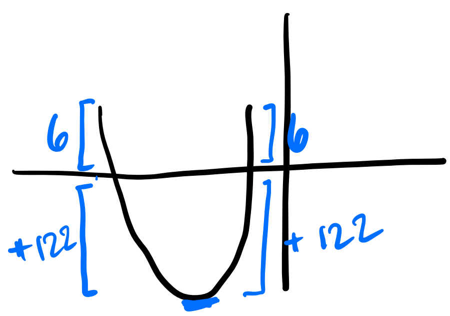
$$-16t = 64$$

$$t = -4$$

$$s(-4) = 8(-4)^2 + 64(-4) + 6$$

$$s(-4) = 128 - 250$$

$$= -122$$



$$d = 6+122+122+6 = \underline{256}$$

speeding up? : $\quad$ $-$ | $+$ at -4

$(-4, \infty)$

12: 10 $7\ln(x^2y^2) = 6$

$7\ln x^2 + 7\ln y^2 = 6$

$14\ln x + 14\ln y = 6$

$\frac{14}{x} + \frac{14}{y}\frac{dy}{dx} = 0$

$\frac{y}{14} \cdot \frac{14}{y}\frac{dy}{dx} = \frac{-\cancel{14}}{x} \cdot \frac{y}{\cancel{14}}$

$\frac{dy}{dx} = \frac{-y}{x}$

12: 8 $\frac{d}{dx}\left(\frac{\sqrt[3]{x-2}}{(1+x^2)^4}\right)$

$y = \frac{\sqrt[3]{x-2}}{(1+x^2)^4}$

$\ln y = \ln\left(\frac{\sqrt[3]{x-2}}{(1+x^2)^4}\right)$

$\ln y = \ln (x-2)^{\frac{1}{3}} - \ln(1+x^2)^4$

$\ln y = \frac{1}{3}\ln(x-2) - 4\ln(1+x^2)$

$\frac{1}{y}\frac{dy}{dx} = \frac{1}{3} \cdot \frac{1}{x-2} - 4 \cdot \frac{1}{1+x^2} \cdot 2x$

$\frac{1}{y}\frac{dy}{dx} = \frac{1}{3(x-2)} - \frac{8x}{1+x^2}$

$\frac{dy}{dx} = \frac{\sqrt[3]{x-2}}{(1+x^2)^4}\left[\frac{1}{3(x-2)} - \frac{8x}{1+x^2}\right]$

12:4 $\frac{d}{dx}\left(\frac{-2\cos x}{\ln x}\right) = \frac{\ln x \cdot 2\sin x + 2\cos x \cdot \frac{1}{x}}{\ln^2 x}$

$$= \frac{2\sin x \cdot \ln x + \frac{2}{x}\cos x}{\ln^2 x}$$

12:6 $\frac{d}{dx}\left(x^{\sin x}\right) \Rightarrow y = x^{\sin x}$

$$\ln y = \ln x^{\sin x}$$

$$\ln y = \sin x \cdot \ln x$$

$$\frac{1}{y}\frac{dy}{dx} = \sin x \cdot \frac{1}{x} + \ln x \cdot \cos x$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{\sin x}{x} + \ln x \cdot \cos x$$

$$\frac{dy}{dx} = x^{\sin x}\left[\frac{\sin x}{x} + \ln x \cos x\right]$$

12:11 $f(x) = \sqrt{x}\ln x$

$$f'(x) = \sqrt{x} \cdot \frac{1}{x} + \ln x \cdot \frac{1}{2}x^{-\frac{1}{2}}$$

$$f'(x) = x^{-\frac{1}{2}} + \frac{1}{2}x^{-\frac{1}{2}}\ln x$$

$$f''(x) = -\frac{1}{2}x^{-\frac{3}{2}} + \frac{1}{2}x^{-\frac{1}{2}} \cdot \frac{1}{x} + \ln x \cdot -\frac{1}{4}x^{-\frac{3}{2}}$$

$$f''(x) = \cancel{\frac{-1}{2x^{3/2}}} + \cancel{\frac{1}{2x^{3/2}}} - \frac{1}{4x^{3/2}} \cdot \ln x$$

$$f''(x) = \frac{-\ln x}{4x^{3/2}}$$