$\sin^{-1}(u)$ $\quad \frac{1}{\sqrt{1-u^2}} \cdot \frac{du}{dx}$

$\cos^{-1}(u)$ $\quad \frac{-1}{\sqrt{1-u^2}} \frac{du}{dx}$

$\tan^{-1}(u)$ $\quad \frac{1}{1+u^2} \cdot \frac{du}{dx}$

$\cot^{-1}(u)$ $\quad \frac{-1}{1+u^2} \frac{du}{dx}$

$\sec^{-1}(u)$ $\quad \frac{1}{|u|\sqrt{u^2-1}} \cdot \frac{du}{dx}$

$\csc^{-1}(u)$ $\quad \frac{-1}{|u|\sqrt{u^2-1}} \frac{du}{dx}$

e^u $\quad e^u \frac{du}{dx}$

$\ln u$ $\quad \frac{1}{u} \frac{du}{dx}$

a^u $\quad a^u \ln a \frac{du}{dx}$

$\log_a u$ $\quad \frac{1}{u \ln a} \cdot \frac{du}{dx}$

$y = x^x$

$\ln y = \ln x^x$

$\ln y = x \ln x$

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

$\frac{dy}{dx} = (1 + \ln x) \cdot y$

$\frac{dy}{dx} = x^x(1 + \ln x)$

$x = 4t^2$ $\quad y = \sqrt{t+1}$ $\quad t = 8$

64
4

$(256, 3)$

$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{\frac{1}{2}(t+1)^{-\frac{1}{2}} \cdot \frac{1}{8t}}{8t \cdot \frac{1}{8t}} = \frac{1}{16t\sqrt{t+1}}$$

velocity

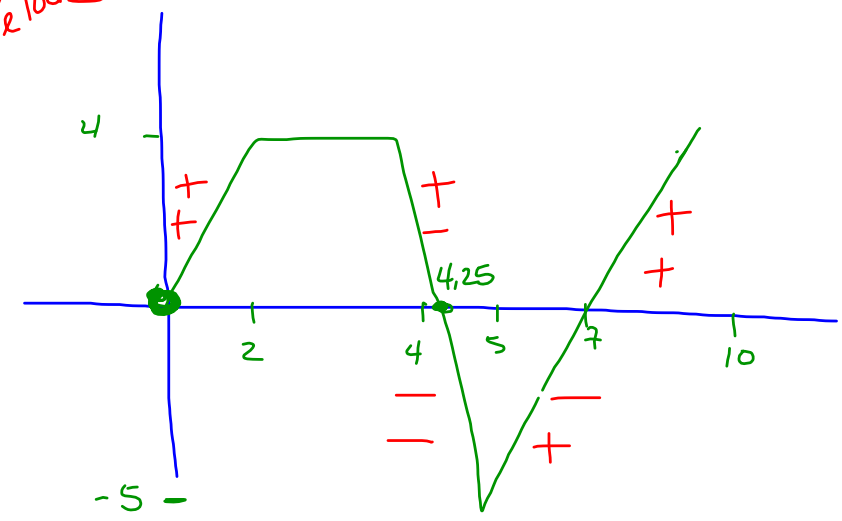
$$\frac{1}{16(8)\sqrt{9}}$$

$48 \cdot 8$
320
64

$\frac{1}{384}$

$y = \frac{1}{384}(x - 256) + 3$

Velocity



Forward (+) velocity $(0, 4.25)$ $(7, 10)$

Back (−) velocity $(4.25, 7)$

Stopped 0 velocity $x = 4.25, 7$

Speeding up:

$\ln(3x^2+4)$ $\quad \frac{1}{3x^2+4} \cdot 6x$

$\frac{6x}{3x^2+4}$

$e^{(2x-5)}$ $\quad e^{2x-5} \cdot 2$

$2e^{2x-5}$

$x = 4t^2 \quad y = \sqrt{t+1} \quad t = 8$

$(256, 3)$

$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{\frac{1}{2}(t+1)^{-\frac{1}{2}}}{8t}\Big|_{t=8}$

$\frac{1}{16t\sqrt{t+1}}\Big|_{t=8} = \frac{1}{16 \cdot 8\sqrt{8+1}}$

$= \frac{1}{384}$

$y = \frac{1}{384}(x-256)+3$

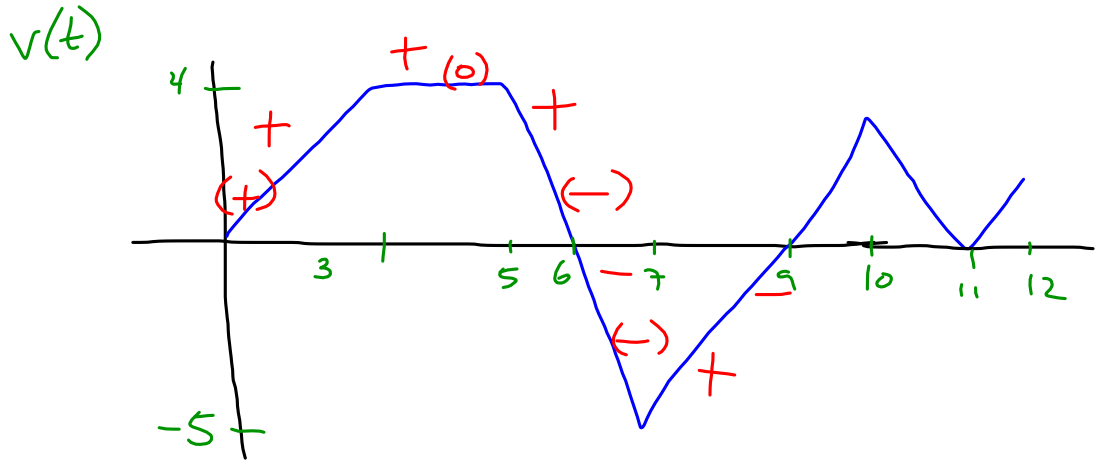
$$xy + y - x = 5$$

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

$$\frac{d^2y}{dx^2} = \frac{(x+1)\left(-1\,\frac{dy}{dx}\right) - (1-y)(1)}{(x+1)^2}$$

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

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



speeding up (0,3) (6,7) (9,10) (11,12)

slowing down (5,6) (7,9) (10,11)

forward (0,6) (9,11) (11,12)

backward (6,9)

stopped t = 0,6,9,11

$$\sin^{-1}\left(\frac{x}{3}\right)$$

$$\frac{1}{\sqrt{1-\left(\frac{x}{3}\right)^2}} \cdot \frac{1}{3}$$

$$\frac{1}{3\sqrt{\frac{9}{9}-\frac{x^2}{9}}} = \frac{1}{3\sqrt{\frac{9-x^2}{9}}}$$

$$\frac{1}{3\frac{\sqrt{9-x^2}}{3}} = \frac{1}{\sqrt{9-x^2}}$$

$$y = x e^{5x+1}$$

$$y' = 5x e^{5x+1} + e^{5x+1}$$

$$e^{5x+1}(5x+1)$$

$$y = (\log_2 x^2)(3^{5x})$$

$$\log_2 x^2 \left(3^{5x} \ln 3 \cdot 5\right) + 3^{5x}\left(\frac{1}{x^2 \ln 2} \cdot 2x\right)$$

$$5(\log_2 x^2)3^{5x} \ln 3 + \frac{(2x)3^{5x}}{x^2 \ln 2}$$

$$x \cdot \sin^2(2x^3 + 5)$$

$$x\Big(\underbrace{2\sin(2x^3+5)}_{\text{power}}\underbrace{\cos(2x^3+5)}_{\text{trig}}\underbrace{6x^2}\Big) + \sin^2(2x^3+5)$$

$$12x^3 \sin(2x^3+5)\cos(2x^3+5) + \sin^2(2x^3+5)$$