$$\frac{d}{dt}\left[\frac{dy}{dt}\right]$$

10.1

(9) $x = -\sqrt{t+1}$ $\quad y = \sqrt{3t}$

(a) $\frac{dy}{dx} = \frac{\cancel{\frac{1}{2}}(3t)^{-\frac{1}{2}}(3)}{-\cancel{\frac{1}{2}}(t+1)^{-\frac{1}{2}}} = \frac{-3(t+1)^{\frac{1}{2}}}{(3t)^{\frac{1}{2}}} = -3\sqrt{\frac{t+1}{3t}} = -3\sqrt{\frac{t}{3t}+\frac{1}{3t}}$

f, g

$= -3\sqrt{\frac{1}{3}+\frac{1}{3t}}$

$= -\sqrt{9\left(\frac{1}{3}+\frac{1}{3t}\right)}$

$\boxed{= -\sqrt{3+\frac{3}{t}}}$

(b) $$\frac{d^2y}{dx} = \frac{\dfrac{-\frac{3}{2}(t+1)^{-\frac{1}{2}}(3t)^{\frac{1}{2}} - \left[\frac{1}{2}(3t)^{-\frac{1}{2}}(3)\right]\left[-3(t+1)^{\frac{1}{2}}\right]}{\left[(3t)^{\frac{1}{2}}\right]^2}}{-\frac{1}{2}(t+1)^{-\frac{1}{2}}}$$

$\cancel{(3t)^{\frac{1}{2}}}$

$$= \frac{\dfrac{\dfrac{-3(3t)^{\frac{1}{2}}}{2(t+1)^{\frac{1}{2}}} - \dfrac{1\cdot 3\cdot -3(t+1)^{\frac{1}{2}}}{2(3t)^{\frac{1}{2}}}}{3t}}{-\frac{1}{2}(t+1)^{-\frac{1}{2}}}$$

$$= \frac{\dfrac{-3(3t)^{\frac{1}{2}}}{2(t+1)^{\frac{1}{2}}} - \dfrac{-9(t+1)^{\frac{1}{2}}}{2(3t)^{\frac{1}{2}}}}{3t\cdot -\frac{1}{2}(t+1)^{-\frac{1}{2}}}$$

$$= \frac{\left[\dfrac{-3(3t)^{\frac{1}{2}}}{\cancel{2}(t+1)^{\frac{1}{2}}} + \dfrac{9(t+1)^{\frac{1}{2}}}{\cancel{2}(3t)^{\frac{1}{2}}}\right] - \cancel{2}(t+1)^{+\frac{1}{2}}}{3t}$$

$$\frac{\left[+3(3t)^{\frac{1}{2}} + \dfrac{-9(t+1)}{3t^{\frac{1}{2}}}\right]\cdot \frac{1}{3t}}{\cancel{3t}}$$

$$\frac{(3t)^{\frac{1}{2}}}{t} - \frac{(t+1)}{t^{3/2}}$$

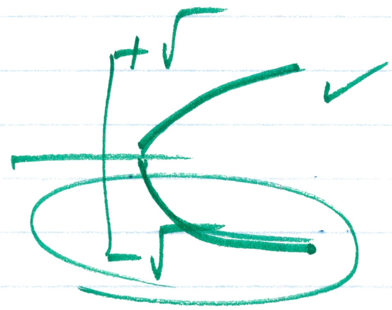
10.1

(3) $x = \tan t \qquad y^{2} = \sec^{2} t \qquad \underline{[0, \frac{\pi}{4}]}$

$$\sec^2 t = 1 + \tan^2 t$$

$$y^2 = 1 + x^2$$

$$y = \pm\sqrt{1+x^2}$$



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

$$\sin(\tan(x+1))$$

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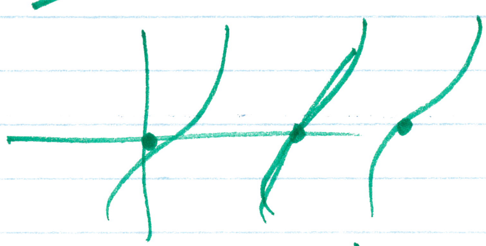
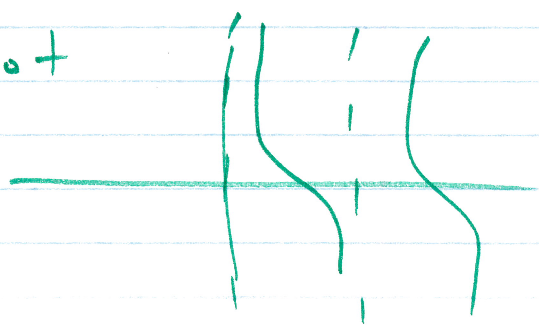
(23) $x = 2 + \cos t \qquad y = -1 + \sin t$

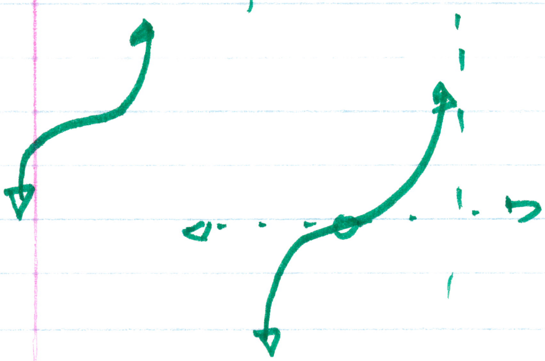
$$\frac{dy}{dx} = \frac{\cos t}{-\sin t} = -\cot t$$

tan t

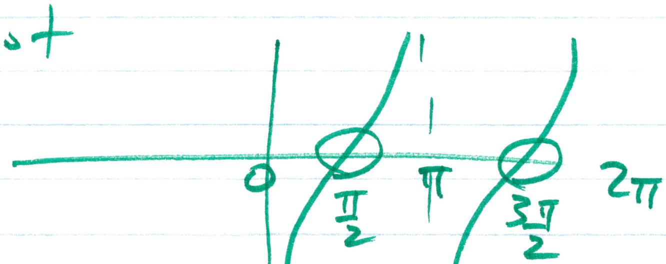


cot





$-\cot$



10.1

(31) $x = \frac{(2t+3)^{3/2}}{3}$ $\qquad y = t + \frac{t^2}{2}$ $\qquad 0 \le t \le 3$

$\frac{\cancel{3}}{\cancel{2}}\frac{(2t+3)^{1/2}[\cancel{2}]}{\cancel{3}}$ $\qquad = 1 + \frac{\cancel{2}t}{\cancel{2}}$

$$s = \int_a^b \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$$

$$= \int_0^3 \sqrt{\left((2t+3)^{1/2}\right)^2 + (1+t)^2}\, dt$$

$$= 10.5$$

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(15) $x = \ln(2t)$ $\qquad y = \ln(3t)^4$

$y = 4\ln(3t)$

$$\frac{dy}{dx} = \frac{\frac{4}{\cancel{3}t}\cdot\cancel{3}}{\frac{1}{\cancel{2}t}\cdot\cancel{2}} = \frac{\frac{4}{t}}{\frac{1}{t}} = 4$$

$$\frac{d^2y}{dx} = \frac{0}{\frac{1}{t}} = 0$$