p. 181 #10 $r = \tan^2(3-\theta^2)$

$r = [\tan(3-\theta^2)]^2$

$\frac{dr}{d\theta} = 2\tan(3-\theta^2)\cdot\sec^2(3-\theta^2)\cdot(-2\theta)$

#4 p. 181

$y = \frac{2x+1}{2x-1}$ $\quad u = 2x+1$ $\quad v = 2x-1$ $\quad u' = 2$ $\quad v' = 2$

$y' = \frac{u'v - uv'}{v^2}$

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

$= \frac{4x-2-4x-2}{(2x-1)^2} = \frac{-4}{(2x-1)^2}$

p. 153 #6

$y = 5\cot\left(\frac{2}{x}\right)$, $u = \frac{2}{x}$

$y = 5\cot u$

Chain Rule: $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$

$\frac{dy}{du} = -5\csc^2 u$ ←

$\frac{du}{dx} = \frac{d}{dx}\left(\frac{2}{x}\right)$

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

$= -2x^{-2}$

$\frac{du}{dx} = -\frac{2}{x^2}$ ←

$= \frac{10\csc^2 u}{x^2}$

$= \frac{10\csc^2\left(\frac{2}{x}\right)}{x^2}$

p. 153 #12 find $v(t)$

$s(t) = \sin\left(\frac{3\pi}{2} \cdot t\right) + \cos\left(\frac{7\pi}{4}t\right)$

$v(t) = \cos\left(\frac{3\pi}{2} \cdot t\right) \cdot \frac{3\pi}{2} - \sin\left(\frac{7\pi}{4}t\right) \cdot \frac{7\pi}{4}$

$= \frac{3\pi}{2}\cos\frac{3\pi}{2}t - \frac{7\pi}{4}\sin\frac{7\pi}{4}t$

Chain Rule p. 153

#23 $y=(1+\cos^2 7x)^3$

$$y=\left(1+[\cos(7x)]^2\right)^3$$

$$\frac{dy}{dx}=3\left(1+[\cos(7x)]^2\right)^2\cdot 2\cos(7x)\cdot(-\sin 7x)\cdot 7$$

$$=-42\sin(7x)\cos(7x)\left(1+[\cos(7x)]^2\right)^2$$

#25 $r=\tan(2-\theta)$

$$\frac{dr}{d\theta}=\sec^2(2-\theta)\cdot(-1)$$

$$=-\sec^2(2-\theta)$$

#31 $y = \cot(3x-1)$

$y' = -\csc^2(3x-1)\cdot 3$

$= -3\csc^2(3x-1)$

$= -3\left[\csc(3x-1)\right]^2$

$y'' = -3\cdot 2\csc(3x-1)\cdot\left(-\csc(3x-1)\cot(3x-1)\right)\cdot 3$

$= 18\csc^2(3x-1)\cot(3x-1)$

p. 162 $y = 2\sin(\pi x - y)$

find tangent, normal @ $(1,0)$

$y' = 2\cos(\pi x-y)\cdot(\pi - y')$

$y' = 2\pi\cos(\pi x-y) - 2y'\cos(\pi x-y)$

$y' + 2y'\cos(\pi x-y) = 2\pi\cos(\pi x-y)$

$y'(1 + 2\cos(\pi x-y)^{-1}) = 2\pi\cos(\pi x-y)^{-1}$

$\cos(\pi x-y)\big|_{(1,0)} = -1$

$y'(1-2) = -2\pi$

$-y' = -2\pi \quad y' = 2\pi$

tangent: $y = 2\pi(x-1)$

$y = 2\pi x - 2\pi$

normal: $y = -\frac{1}{2\pi}(x-1)$

Point $(x_1, y_1)$

Slope $m$ normally, a derivative at a point

tangent $y = y_1 + m(x - x_1)$

position, velocity, accel.

| $s(t)$ | $v(t)$ | $a(t)$ |
|---|---|---|
| | $\frac{ds}{dt}$ | $\frac{dv}{dt}$ |
| | speed $= \lvert v(t) \rvert$ | $\frac{d^2s}{dt^2}$ |

$s(t) = 3t^2 - 5t + 2$ meters / sec

Q: what is acceleration @ $t = 3$ sec

$v(t) = 6t - 5$

$a(t) = 6$ $\quad a(3) = 6 \frac{m/s}{s}$