Sec 3.3 p.195 (1-10, 23, 31)

① $f(x) = 3x^2 - 2\cos x$

$f'(x) = 6x + 2\sin x$

② $y = 2\csc x + 5\cos x$

$y' = -2\csc x\cot x - 5\sin x$

③ $f(x) = \sin x + \frac{1}{2}\cot x$

$f'(x) = \cos x - \frac{1}{2}\csc^2 x$

④ $f(x) = \sqrt{x}\sin x$

$f = x^{1/2}$ $\quad g = \sin x$

$f' = \frac{1}{2\sqrt{x}}$ $\quad g' = \cos x$

$f'(x) = \frac{\sin x}{2\sqrt{x}} + \sqrt{x}\cos x$

⑤ $y = \sec\theta\tan\theta$

$f = \sec\theta$ $\quad g = \tan\theta$

$f' = \sec\theta\tan\theta$ $\quad g' = \sec^2\theta$

$y' = \tan\theta(\sec\theta\tan\theta) + \sec^3\theta$

$y' = \sec\theta(\tan^2\theta + \sec^2\theta)$

* use identity $\sec^2\theta = 1 + \tan^2\theta$

$y' = \sec\theta(\tan^2\theta + (1 + \tan^2\theta))$

$y' = \sec\theta(1 + 2\tan^2\theta)$

⑥ $g(\theta) = e^\theta(\tan\theta - \theta)$

$f = e^\theta$ $\quad g = \tan\theta - \theta$

$f' = e^\theta$ $\quad g' = \sec^2\theta - 1$

$g'(\theta) = e^\theta(\tan\theta - \theta) + e^\theta(\sec^2\theta - 1)$

$g'(\theta) = e^\theta(\tan\theta + \sec^2\theta - \theta - 1)$ $\rightarrow \sec^2\theta - 1 = \tan^2\theta$

$g'(\theta) = e^\theta(\tan^2\theta + \tan\theta - \theta)$

(7) $y = c\cos t + t^2 \sin t$

$$\boxed{y' = -c\sin t + 2t\sin t + t^2\cos t}$$

(8) $f(t) = \dfrac{\cot t}{e^t}$

$f = \cot t \qquad g = e^t$

$f' = -\csc^2 t \qquad g' = e^t$

$$f'(t) = \frac{-e^t\csc^2 t - e^t\cot t}{e^{2t}} = \frac{-e^t(\csc^2 t + \cot t)}{e^{2t}}$$

$$= \boxed{-\frac{\csc^2 t + \cot t}{e^t}}$$

(9) $y = \dfrac{x}{2-\tan x}$

$f = x \qquad g = 2 - \tan x$

$f' = 1 \qquad g' = -\sec^2 x$

$$y' = \frac{2-\tan x - (-x\sec^2 x)}{(2-\tan x)^2} = \boxed{\frac{2-\tan x + x\sec^2 x}{(2-\tan x)^2}}$$

(10) $y = \dfrac{1+\sin x}{x+\cos x}$

$f = 1 + \sin x \qquad g = x + \cos x$

$f' = \cos x \qquad g' = 1 - \sin x$

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

$$= \frac{x\cos x - 1 + \overbrace{(\sin^2 x + \cos^2 x)}^{1}}{(x+\cos x)^2} = \boxed{\frac{x\cos x}{(x+\cos x)^2}}$$

(23) a) $y = 2x\sin x \quad (\pi/2, \pi)$

$y' = 2\sin x + 2x\cos x$

$y'(\pi/2) = 2\sin(\pi/2) + 2\pi/2 \cos(\pi/2)$

$= 2(1) \quad + 2\pi/2\,(0)$

$= 2$

$\boxed{y - \pi = 2(x - \pi/2)}$ or $y = 2x$

b) graph

(31) $f(x) = x + 2\sin x$

$f'(x) = 1 + 2\cos x$

$f'(x) = 0$ when $0 = 1 + 2\cos x$

so $\frac{-1}{2} = \cos x$

$x = \frac{2\pi}{3}, \frac{4\pi}{3} \ldots \pm\frac{\pi}{3}$ units away from π ...