2) $f(x) = -2\sin x \quad @ \; x = \frac{3\pi}{4}$

$f\left(\frac{3\pi}{4}\right) = -2\sin\left(\frac{3\pi}{4}\right) = -2 \cdot \frac{\sqrt{2}}{2} = -\sqrt{2}$

$f'(x) = -2\cos x$

$f'\left(\frac{3\pi}{4}\right) = -2\cos\left(\frac{3\pi}{4}\right) = -2 \cdot -\frac{\sqrt{2}}{2} = \sqrt{2}$

$y + \sqrt{2} = \sqrt{2}\left(x - \frac{3\pi}{4}\right)$

$y = \sqrt{2}x - \frac{3\pi}{4}\sqrt{2} - \sqrt{2}$

6) $f(x) = (\sin x + 2\tan x)(\sec x - 3\csc x)$

$f'(x) = (\sin x + 2\tan x)(\sec x \tan x + 3\csc x \cot x)$

$+ (\sec x - 3\csc x)(\cos x + 2\sec^2 x)$

4) $f(x) = \dfrac{x - \cos x}{x^2 + \cot x}$

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

5) $f(x) = \dfrac{x^2 + \sec x}{x - 2e^x}$

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

$$f(x) = \begin{cases} \sin x, & x < 0 \\ 1 - \cos x, & x \geq 0 \end{cases}$$

$\lim_{x \to 0^+} \dfrac{f(x) - f(0)}{x - 0} \stackrel{?}{=} 1$ $\quad\quad$ $\lim_{x \to 0^-} \dfrac{f(x) - f(0)}{x - 0} = 0$

not continuous

not differentiable

$\sin(0) = 0 \quad 1 - \cos(0) = 0$

$f(1) = 2 \quad g(1) = 2 \quad f'(1) = 1 \quad f'(2) = 3$

$g'(1) = 6 \quad g'(2) = 4$

Find $F'(1)$ if $F(x) = f(g(x))$

$F'(x) = f'(g(x)) \cdot g'(x)$

$F'(1) = f'(g(1)) \cdot g'(1) = f'(2) \cdot 6 = 3 \cdot 6 = 18$