$$y = f \cdot g$$

$$y' = f \cdot g' + g \cdot f'$$

---

3 $h(t) = \sqrt{t}\,(1 - t^2)$

$$h(t) = t^{1/2} - t^{5/2}$$

$$h'(t) = \frac{1}{2} t^{-1/2} - \frac{5}{2} t^{3/2}$$

17.) $f(x) = \overset{f}{x}\,\overset{g}{\cos x}$ $\qquad c = \frac{\pi}{4}$

$$f'(x) = x(-\sin x) + \cos x \cdot 1$$

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

$$= \frac{-\sqrt{2}\,\pi}{8} + \frac{\sqrt{2}}{2}$$

53.) $y = \overbrace{2x}^{f}\,\overbrace{\sin x}^{g} + \overbrace{x^2}^{f}\,\overbrace{\cos x}^{g}$

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

$y' = 4x\cos x + 2\sin x - x^2 \sin x$

2.3 continued   The Quotient Rule

$$\frac{d}{dx}\left[\frac{f}{g}\right] = \frac{g \cdot f' - f \cdot g'}{g^2}$$

$$\frac{d}{dx}\left[\frac{Hi}{Lo}\right] = \frac{Lo \cdot dHi - Hi \cdot dLo}{Lo^2}$$

#1

$$f(x) = \frac{5x+4}{x+2}$$

$$f'(x) = \frac{(x+2)5 - (5x+4)\cdot 1}{(x+2)^2}$$

$$= \frac{5x+10-5x-4}{(x+2)^2}$$

$$f'(x) = \frac{6}{(x+2)^2}$$

#2 $f(x) = \dfrac{\cos x}{x^2}$

$$f'(x) = \frac{x^2(-\sin x) - \cos x(2x)}{x^4}$$

$$= \frac{-x(x\sin x + 2\cos x)}{x^4}$$

$$f'(x) = \frac{-(x\sin x + 2\cos x)}{x^3}$$

#3 $h(s) = \frac{s}{\sqrt{s} - 1}$ $h(x) = \frac{x}{\sqrt{x} - 1}$

$$h'(x) = \frac{(x^{1/2} - 1)\cdot 1 - x^1 \cdot \frac{1}{2} x^{-1/2}}{(\sqrt{x} - 1)^2}$$

$$\frac{\frac{1}{2}}{1} = \frac{1}{2}$$

$$h'(x) = \frac{1x^{1/2} - 1 - \frac{1}{2} x^{1/2}}{(\sqrt{x} - 1)^2} = \frac{\frac{1}{2} x^{1/2} - \frac{2}{2}}{(\sqrt{x} - 1)^2}$$

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

#4 Find f'(c)

$$f(x) = \frac{x+5}{x-5} \qquad c = 4$$

$$f'(x) = \frac{(x-5)\cdot 1 - (x+5)\cdot 1}{(x-5)^2}$$

$$f'(4) = \frac{-10}{(4-5)^2}$$

$$= -10$$

#5 Find f'(c)

$$f(x) = \frac{\sin x}{x} \qquad c = \frac{\pi}{6}$$

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

$$f'\left(\frac{\pi}{6}\right) = \frac{\frac{\pi}{6} \cdot \frac{\sqrt{3}}{2} - \frac{1}{2}}{\frac{\pi^2}{36}} = \left(\frac{\pi\sqrt{3}}{12} - \frac{1}{2}\right) \cdot \frac{36}{\pi^2}$$

$$\frac{\pi\sqrt{3} - 6}{12} \cdot \frac{36}{\pi^2}$$

$$\frac{3(\pi\sqrt{3} - 6)}{\pi^2}$$

#6 Find an equation of the tangent line to f(x) at the given point

$$f(x) = \frac{(x-1)}{(x+1)}, \quad \left(2, \frac{1}{3}\right)$$

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

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

$$y - \frac{1}{3} = \frac{2}{9}(x-2)$$

$$f'(2) = \frac{2}{9}$$

#7 Find the points where f(x) has a horizontal tangent

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

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

$$(0, 0)$$

$$f'(x) = \frac{2x^3 + 2x - 2x^3}{(x^2+1)^2}$$

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

$$0 = \frac{2x}{(x^2+1)^2}$$