Quotient Rule

$$y = \frac{f}{g} \qquad y' = \frac{g \cdot f' - f \cdot g'}{g^2}$$

Derivative Notation

1st deriv. $f'(x)$ $\quad y'$ $\quad \frac{dy}{dx}$ $\quad \frac{d}{dx}[f(x)]$ $\quad D_x[y]$

2nd deriv. $f''(x)$ $\quad y''$ $\quad \frac{d^2y}{dx^2}$

3rd deriv $f'''(x)$ $\quad y'''$ $\quad \frac{d^3y}{dx^3}$

4th deriv. $f^{(4)}(x)$ $\quad y^{(4)}$ $\quad \frac{d^4y}{dx^4}$

etc.

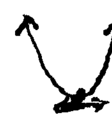
EX1 Find the eqn of the tangent line at $x=2$ for $f(x)=3x^2-7x+1$.

slope $f'(x) = 6x-7$

$f'(2) = 6\cdot 2 - 7 = 5$ point $(2,-1)$

$$y-(-1) = 5(x-2)$$
$$y+1 = 5(x-2)$$

EX2 Find the horizontal tangents of the curve $f(x) = 4x^2 - 6x + 5$



$(3/4, 2.75)$

$$f'(x) = 8x - 6 = 0$$
$$x = \frac{6}{8} = \frac{3}{4}$$
$$f\left(\tfrac{3}{4}\right) = 2.75$$

$\boxed{y = 2.75 \text{ horiz. tang.}}$

EX3 Given $g(2)=3$, $g'(2)=-2$, $h(2)=-1$, and $h'(2)=4$. Find $f'(2)$ if:

a. $f(x) = 4 - h(x)$

$$f'(x) = -h'(x)$$
$$f'(2) = -h'(2) = \boxed{-4}$$

b. $f(x) = g(x) \cdot h(x)$

$$f'(x) = g(x) \cdot h'(x) + h(x) \cdot g'(x)$$

$$f'(2) = g(2) \cdot h'(2) + h(2) \cdot g'(2)$$

$$3 \cdot 4 + -1 \cdot -2$$

$$\boxed{14}$$

EX4 $g(x) = 2\sec^2 x = \underbrace{2\sec x} \cdot \underbrace{\sec x}$

Find $g'(x)$.

$$g'(x) = 2\sec x \cdot \sec x \tan x + \sec x \cdot 2\sec x \tan x$$

$$= 2\sec^2 x \tan x + 2\sec^2 x \tan x$$

$$= 4\sec^2 x \tan x$$

EX5 $f(x) = x^6$. Find $f^{(4)}(x)$.

$$f'(x) = 6x^5$$

$$f''(x) = 30x^4$$

$$f'''(x) = 120x^3$$

$$f^{(4)}(x) = 360x^2$$