

Rule 1 $f(x) = ax^n$ $f'(x) = anx^{n-1}$

Rule 2 PRODUCT RULE

$$f(x) = uv$$

$$f'(x) = u \frac{dv}{dx} + v \frac{du}{dx}$$

Rule 3 QUOTIENT RULE

$$f(x) = \frac{u}{v}$$

$$f'(x) = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$$

eg. $y = (x+2)(x^2-3)$

$\frac{dy}{dx} = ?$

Rule 2 PRODUCT RULE

$$f(x) = uv$$

$$f'(x) = u \frac{dv}{dx} + v \frac{du}{dx}$$

$v = x^2 - 3$	$u = x + 2$
$\frac{dv}{dx} = 2x$	$\frac{du}{dx} = 1$

$$\begin{aligned} f'(x) &= (x+2)2x + (x^2-3)(1) \\ &= 2x^2 + 4x + x^2 - 3 \\ &= 3x^2 + 4x - 3 \end{aligned}$$

$$y = (x+3)(x^2-6x+8), \quad \frac{dy}{dx} = ?$$

$$u = x+3 \qquad v = x^2-6x+8$$

$$\frac{du}{dx} = 1 \qquad \frac{dv}{dx} = 2x-6$$

$$\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx} = (x+3)(2x-6) + (x^2-6x+8)(1)$$

$$= 2x^2-6x+6x-18 + x^2-6x+8$$

$$= 3x^2-6x-10$$

Rule 3

QUOTIENT RULE

$$f(x) = \frac{u}{v}$$

$$f'(x) = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$$

eg.

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

$$v = x^2+2$$

$$u = 2x-1$$

$$\frac{dv}{dx} = 2x$$

$$\frac{du}{dx} = 2$$

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

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

HW 11-9-2012

FIND $\frac{dy}{dx}$:

$$\textcircled{1} \quad y = \frac{3x-1}{x^2-2}$$

* QUOTIENT
RULE

$$u = 3x-1 \quad v = x^2-2$$

$$\frac{du}{dx} = 3 \quad \frac{dv}{dx} = 2x$$

$$\frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2} = \frac{(x^2-2)(3) - (3x-1)(2x)}{(x^2-2)^2}$$

$$= \frac{3x^2 - 6 - 6x^2 + 2x}{(x^2-2)^2} = \frac{-3x^2 + 2x - 6}{(x^2-2)^2}$$

$$\textcircled{2} \quad y = \frac{x^2-x-6}{x^2+x-6}$$

QUOTIENT
RULE

$$\frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$$

$$u = x^2-x-6 \quad v = x^2+x-6$$

$$\frac{du}{dx} = 2x-1 \quad \frac{dv}{dx} = 2x+1$$

$$\frac{dy}{dx} = \frac{(x^2+x-6)(2x-1) - (x^2-x-6)(2x+1)}{(x^2+x-6)^2} =$$

$$= \frac{\cancel{2x^3} + \cancel{2x^2} - \cancel{12x} - \cancel{x^2} - \cancel{x} + 6 - \cancel{2x^3} + \cancel{2x^2} + \cancel{12x} - \cancel{x^2} + \cancel{x} + 6}{(x^2+x-6)^2}$$

$$= \frac{2x^2 + 12}{(x^2+x-6)^2}$$

$$\textcircled{3} \quad y = (5x^2 - 3x)(x^2 - 5x)$$

PRODUCT RULE

$$u = 5x^2 - 3x$$

$$v = x^2 - 5x$$

$$\frac{du}{dx} = 10x - 3$$

$$\frac{dv}{dx} = 2x - 5$$

$$\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx} = (5x^2 - 3x)(2x - 5) + (x^2 - 5x)(10x - 3)$$

$$= 10x^3 - 6x^2 - 25x^2 + 15x + 10x^3 - 50x^2 - 3x^2 + 15x$$

$$= 20x^3$$

$$\textcircled{4} \quad y = (3x - 4)(x^2 - 2x + 3)$$

$$u = 3x - 4$$

$$v = x^2 - 2x + 3$$

$$\frac{du}{dx} = 3$$

$$\frac{dv}{dx} = 2x - 2$$

$$\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx} = (3x - 4)(2x - 2) + (x^2 - 2x + 3)(3)$$

$$= 6x^2 - 6x - 12x + 8 + 3x^2 - 6x + 9$$

$$= 9x^2 - 24x + 17$$