

## 15.1 微分法的法則

1.  $\frac{d}{dx}(c) = 0$

2.  $\frac{d}{dx}(x^n) = nx^{n-1}$  冪規律 Power Rule

3.  $\frac{d}{dx}[kf(x)] = k \frac{d}{dx}[f(x)]$

4.  $\frac{d}{dx}(u \pm v) = \frac{du}{dx} \pm \frac{dv}{dx}$

5.  $\frac{d}{dx}(uv) = u \frac{dv}{dx} + v \frac{du}{dx}$  積法則 Product Rule

6.  $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$  商法則 Quotient Rule

## 15.2 複合函數的微分法

## 7. Chain Rule 鏈式法則

若  $y = g(u)$  及  $u = h(x)$ 

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

## 15.3 反函數與參數函數的微分法

## 8. Inverse Function 反函數法則

$$\frac{dy}{dx} = \frac{1}{\frac{dx}{dy}}$$

## 9. Parametric Function 參數函數的微分法

若  $\begin{cases} x = f(t) \\ y = g(t) \end{cases}$ ,  $\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$

## 10. Implicit Function 隱函數的微分法

若  $x^2 + 2xy + y^2 = 4$   
$$\frac{d(x^2 + 2xy + y^2)}{dx} = \frac{d(4)}{dx}$$

$$\frac{dx^2}{dx} + \frac{d2xy}{dx} + \frac{dy^2}{dx} = 0$$

$$2x + 2\left(x \frac{dy}{dx} + y \frac{dx}{dx}\right) + \frac{dy^2}{dy} \cdot \frac{dy}{dx} = 0$$

$$2x + 2\left(x \frac{dy}{dx} + y\right) + 2y \cdot \frac{dy}{dx} = 0$$

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

$$\frac{dy}{dx} = \frac{-(x+y)}{(x+y)}$$

## 11. Second Derivatives 高階導數

$$\frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{dy}{dx}\right)$$