

مراجعة في قواعد التفاضل



$$(1) \frac{d}{dx} f(x) \pm g(x) = f'(x) \pm g'(x)$$

$$(2) \frac{d}{dx} (f(x) \cdot g(x)) = f(x) \cdot g'(x) + f'(x) \cdot g(x)$$

$$(3) \frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) = \frac{g(x) \cdot f'(x) - f(x) \cdot g'(x)}{(g(x))^2}$$

$$(4) \frac{d}{dx} (f(x))^n = n(f(x))^{n-1} \cdot f'(x)$$



$$(5) \frac{d}{dx} \ln x = \frac{1}{x}$$

$$(6) \frac{d}{dx} \ln f(x) = \frac{f'(x)}{f(x)}$$

$$(7) \frac{d}{dx} e^x = e^x$$

$$(8) \frac{d}{dx} e^{f(x)} = e^{f(x)} \cdot f'(x)$$

$$(9) \frac{d}{dx} (a)^{f(x)} = a^{f(x)} \cdot f'(x) \cdot \ln a$$



Note

$$(10) \ln e^x = x$$

$$(11) \ln a + \ln b = \ln(a \cdot b) \quad \left(\begin{array}{l} \text{مثال} \\ \text{مثال} \end{array} \right)$$

$$(12) \ln a - \ln b = \ln \left(\frac{\ln a}{\ln b} \right) \quad \left(\begin{array}{l} \text{مثال} \\ \text{مثال} \end{array} \right)$$

$$(13) a^{x+y} = a^x \cdot a^y$$

(1)



تفاضل الدوال (المثلثية)

$$\frac{d}{dx} \sin x = \cos x$$

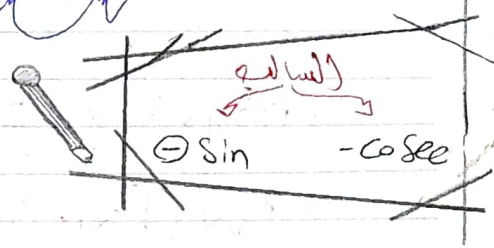
$$\frac{d}{dx} \cos x = -\sin x$$

$$\frac{d}{dx} \tan x = \sec^2 x$$

$$\frac{d}{dx} \operatorname{cosec} x = -\operatorname{cosec} x \cdot \cot x$$

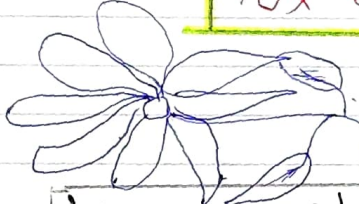
$$\frac{d}{dx} \sec x = \sec x \cdot \tan x$$

$$\frac{d}{dx} \cot x = -\operatorname{cosec}^2 x$$



By Note

$$\frac{d}{dx} \sin f(x) = \cos f(x) \cdot f'(x)$$



تفاضل الدوال (العكسية)

$$\frac{d}{dx} \sin^{-1} x = \frac{+1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx} \cos^{-1} x = \frac{-1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx} \operatorname{cosec}^{-1} x = \frac{-1}{x\sqrt{x^2-1}}$$

$$\frac{d}{dx} \sec^{-1} x = \frac{+1}{x\sqrt{x^2-1}}$$

$$\frac{d}{dx} \tan^{-1} x = \frac{+1}{1+x^2}$$

$$\frac{d}{dx} \cot^{-1} x = \frac{-1}{1+x^2}$$

(Note)

$$\frac{d}{dx} \sin^{-1} f(x) = \frac{f'(x)}{\sqrt{1-f(x)^2}}$$



تفاضل الدوال الدائرية

Note

في الدوال الدائرية
انقلوا
سوالين

$$\frac{d}{dx} \sinh x = \cosh x$$

$$\frac{d}{dx} \cosh x = \sinh x$$

$$\frac{d}{dx} \tanh x = \operatorname{sech}^2 x$$

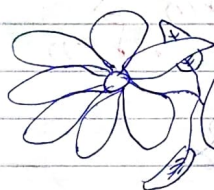
$$\frac{d}{dx} \operatorname{cosech} x = -\operatorname{cosech} x \cdot \coth x$$

$$\frac{d}{dx} \operatorname{sech} x = -\operatorname{sech} x \cdot \tanh x$$

$$\frac{d}{dx} \coth x = -\operatorname{cosech}^2 x$$

Note

$$\frac{d}{dx} \sinh f(x) = \cosh f(x) \cdot f'(x)$$



تفاضل الدوال الدائرية العكسية

$$\frac{d}{dx} \sinh^{-1} x = \frac{1}{\sqrt{x^2 + 1}}$$

$$\frac{d}{dx} \cosh^{-1} x = \frac{1}{\sqrt{x^2 - 1}}$$

$$\frac{d}{dx} \tanh^{-1} x = \frac{1}{1 - x^2}$$

Note

$$\frac{d}{dx} \tan^{-1} f(x) = \frac{f'(x)}{1 - f(x)^2}$$

مرادفات (قواعد التكامل)

$$\int [f(x) \pm g(x)] dx = \int f(x) dx \pm \int g(x) dx$$

$$\int (f(x))^n f'(x) dx = \frac{(f(x))^{n+1}}{n+1} + C$$

$$\int \frac{f'(x)}{f(x)} dx = \ln |f(x)| + C$$

$$\int \frac{f'(x)}{\sqrt{f(x)}} dx = 2\sqrt{f(x)} + C$$

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C$$

$$\int e^{f(x)} f'(x) dx = \frac{e^{f(x)}}{f'(x)} \rightarrow \frac{d}{dx} e^{f(x)} = e^{f(x)} \cdot f'(x)$$

قواعد التفاضل

$$\int \cot x dx = \ln |\sin x| + C$$

$$\int \tan x dx = -\ln |\cos x| + C$$

$$\int \sec x dx = \ln |\sec x + \tan x| + C$$

Note

$$\star \sin^2 x + \cos^2 x = 1$$

$$\star \sin 2x = 2 \sin x \cdot \cos x$$

$$\star \cos^2(x) = \frac{1}{2} [1 + \cos 2x]$$

$$\star \sin^2(x) = \frac{1}{2} [1 - \cos 2x]$$

(4)

$$\int \csc x dx = \ln |\csc x - \cot x| + C$$

$$\star \tan^2 x + 1 = \sec^2 x$$

$$\star \cot^2 x + 1 = \operatorname{cosec}^2 x$$

$$\Rightarrow \tan x = \frac{\sin x}{\cos x} \Rightarrow \cot x = \frac{\cos x}{\sin x}$$

تذكير: $\tan x = \frac{\sin x}{\cos x}$ و $\cot x = \frac{\cos x}{\sin x}$

$$\int \cos 2x \, dx = \frac{\sin 2x}{2} + C$$

$$\int \sin 2x \, dx = -\frac{\cos 2x}{2} + C$$

$$\int \sec^2 2x \, dx = \frac{\tan 2x}{2} + C$$

التكامل بالتجزئة

$$\int u \, dv = uv - \int v \, du$$

تذكير: $\int u \, dv = uv - \int v \, du$

$$\int \frac{\pm dx}{\sqrt{a^2 - x^2}} = \begin{cases} \oplus \sin^{-1} \frac{x}{a} + C \\ \ominus \cos^{-1} \frac{x}{a} + C \end{cases}$$

$$\int \frac{dx}{\sqrt{a^2 - x^2}} \Rightarrow x = a \sin \theta$$

Notes: $1 - \sin^2 \theta = \cos^2 \theta$

$$\int \frac{\pm dx}{a^2 + x^2} = \begin{cases} \oplus \frac{1}{a} \tan^{-1} \frac{x}{a} + C \\ \ominus \frac{1}{a} \cot^{-1} \frac{x}{a} + C \end{cases}$$

$$\int \frac{dx}{a^2 + x^2} \Rightarrow x = a \tan \theta$$

Notes: $1 + \tan^2 \theta = \sec^2 \theta$

$$\int \frac{dx}{x \sqrt{x^2 - a^2}} = \frac{1}{a} \sec^{-1} \frac{x}{a} + C$$

$$\int \frac{dx}{x \sqrt{x^2 - a^2}} \Rightarrow x = a \sec \theta$$

Notes: $\sec^2 \theta - 1 = \tan^2 \theta$

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