

تفاضل وتكامل ١

ملخص قوانين الاشتقاق

Differentiation Formulas

أحبي الطلبة

لقد قمنا بجمع قوانين الاشتقاق للباب الثالث في هذا الملف لمساعدتكم في حفظها واستخدامها لأن إتقانكم للإشتقاق يتطلب منكم حفظ القوانين التالية والتدريب على استخدامها في التمارين

مع تمنياتنا لكم بالنجاح والتفوق

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التالي <https://cutt.us/calculus1uhb>

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

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

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

$$(cf)' = cf'$$

$$(f + g)' = f' + g'$$

$$(f - g)' = f' - g'$$

$$(fg)' = fg' + gf'$$

$$\left(\frac{f}{g}\right)' = \frac{gf' - fg'}{g^2}$$

Derivatives of Trigonometric Functions

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

$$\frac{d}{dx}(\csc x) = -\csc x \cot x$$

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

$$\frac{d}{dx}(\sec x) = \sec x \tan x$$

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

$$\frac{d}{dx}(\cot x) = -\csc^2 x$$

Derivatives of Inverse Trigonometric Functions

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

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

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

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

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

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

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

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

$$\frac{d}{dx} \ln|x| = \frac{1}{x}$$

$$\frac{d}{dx} [\ln g(x)] = \frac{g'(x)}{g(x)}$$

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

$$\frac{d}{dx} (a^x) = a^x \ln a$$

Definition of the Hyperbolic Functions

$$\sinh x = \frac{e^x - e^{-x}}{2}$$

$$\operatorname{csch} x = \frac{1}{\sinh x}$$

$$\cosh x = \frac{e^x + e^{-x}}{2}$$

$$\operatorname{sech} x = \frac{1}{\cosh x}$$

$$\tanh x = \frac{\sinh x}{\cosh x}$$

$$\operatorname{coth} x = \frac{\cosh x}{\sinh x}$$

Hyperbolic Identities

$$\sinh(-x) = -\sinh x$$

$$\cosh(-x) = \cosh x$$

$$\cosh^2 x - \sinh^2 x = 1$$

$$1 - \tanh^2 x = \operatorname{sech}^2 x$$

$$\sinh(x + y) = \sinh x \cosh y + \cosh x \sinh y$$

$$\cosh(x + y) = \cosh x \cosh y + \sinh x \sinh y$$

1 Derivatives of Hyperbolic Functions

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

$$\frac{d}{dx} (\operatorname{csch} x) = -\operatorname{csch} x \coth x$$

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

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

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

$$\frac{d}{dx} (\operatorname{coth} x) = -\operatorname{csch}^2 x$$

6 Derivatives of Inverse Hyperbolic Functions

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

$$\frac{d}{dx} (\operatorname{csch}^{-1} x) = -\frac{1}{|x|\sqrt{x^2+1}}$$

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

$$\frac{d}{dx} (\operatorname{sech}^{-1} x) = -\frac{1}{x\sqrt{1-x^2}}$$

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

$$\frac{d}{dx} (\operatorname{coth}^{-1} x) = \frac{1}{1-x^2}$$

The Chain Rule If g is differentiable at x and f is differentiable at $g(x)$, then the composite function $F = f \circ g$ defined by $F(x) = f(g(x))$ is differentiable at x and F' is given by the product

$$F'(x) = f'(g(x)) \cdot g'(x)$$

In Leibniz notation, if $y = f(u)$ and $u = g(x)$ are both differentiable functions, then

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

4 The Power Rule Combined with the Chain Rule If n is any real number and $u = g(x)$ is differentiable, then

$$\frac{d}{dx} (u^n) = nu^{n-1} \frac{du}{dx}$$

Alternatively,

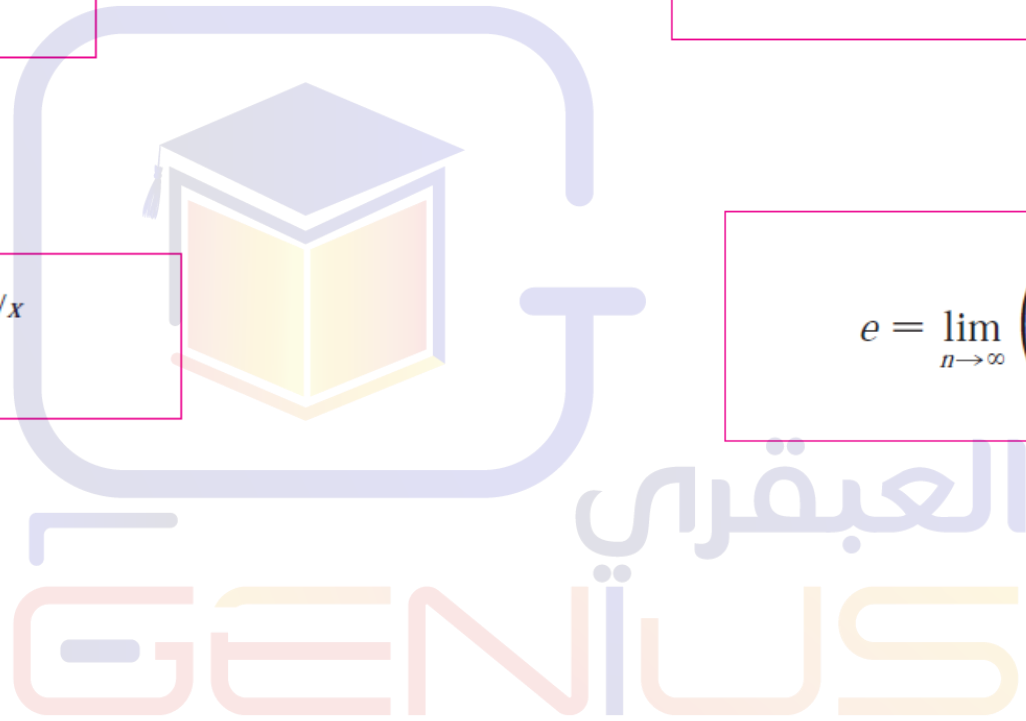
$$\frac{d}{dx} [g(x)]^n = n[g(x)]^{n-1} \cdot g'(x)$$

$$\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$$

$$\lim_{\theta \rightarrow 0} \frac{\cos \theta - 1}{\theta} = 0$$

$$e = \lim_{x \rightarrow 0} (1 + x)^{1/x}$$

$$e = \lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n$$



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