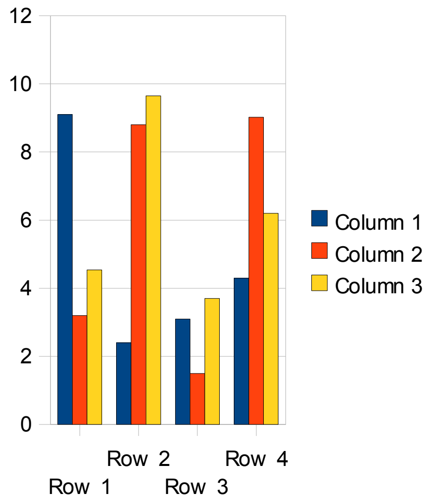
Mathematical Tables



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بسم الله الرحمن الرحيم

مقدمة

سيتم فى هذا الجزء استكمال كتاب معادلات فى

الرياضيات الهندسية والذى يحتوى على صيغ

وتعريفات لمعادلات هامة يمكن ان تفيد الباحثين فى

مجال الرياضيات الهندسية

السفيانى

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Derivatives

$(\bar{c})=0, c=constant.$
$(\bar{x})=1$
$(\bar{x}^n)=n x^{(n-1)}$
$[\bar{\frac{1}{x}}]=\frac{-1}{x^2}, [\frac{1}{x}]^{(n)}=(-1)^n \frac{n!}{(x^{(n+1)})}$
$(\bar{\sqrt{x}})=\frac{1}{(2\sqrt{x})}$
$(\bar{\sqrt{x}})=\frac{1}{(2\sqrt{x})}$
$(\bar{\sqrt[n]{x}})=\frac{1}{(n\sqrt[n]{x^{(n-1)}})}$
$(\bar{e}^x)=e^x, (\bar{e}^u)=e^u . \bar{u}$
$(\bar{a}^x)=a^x \mathbf{ln}\, a$
$(\bar{\mathbf{ln}}\, x)=\frac{1}{x}, (\mathbf{ln}\, x)^{(n)}=\frac{(-1)^n*(n-1)!}{x^n}$
$(\bar{\mathbf{log}}_a x)=\frac{1}{x}\mathbf{log}_a e=\frac{1}{(x\, \mathbf{ln}\, a)}$
$(\bar{\mathbf{sin}}\, x)=\mathbf{cos}\, x, (\mathbf{sin}\, ax)^{(n)}=a^n \mathbf{sin}[ax+n\frac{\pi}{2}]$
$(\bar{\mathbf{cos}}\, x)=-\mathbf{sin}\, x, (\mathbf{cos}\, ax)^{(n)}=a^n \mathbf{cos}[ax+n\frac{\pi}{2}]$
$(\bar{\mathbf{tan}}\, x)=\frac{1}{(\mathbf{cos}^2 x)}=sec^2 x$
$(\bar{\mathbf{cot}}\, x)=\frac{-1}{(\mathbf{sin}^2 x)}=-cosec^2 x$

$(\overline{sec}\,x) = \boldsymbol{tan}\,x\,sec\,x$
$(\overline{cosec}\,x) = -\boldsymbol{cot}\,x\,cosec\,x$
$(\overline{\boldsymbol{sin}}^{-1}\,x) = \frac{1}{\sqrt{(1-x^2)}}$
$(\overline{\boldsymbol{cos}}^{-1}\,x) = \frac{-1}{\sqrt{(1-x^2)}}$
$(\overline{\boldsymbol{tan}}^{-1}\,x) = \frac{1}{(1+x^2)}$
$(\overline{\boldsymbol{cot}}^{-1}\,x) = \frac{-1}{(1+x^2)}$
$(\overline{sec}^{-1}\,x) = \frac{1}{(x\sqrt{(x^2-1)})}$
$(\overline{cosec}^{-1}\,x) = \frac{-1}{(x\sqrt{(x^2-1)})}$
$(\overline{sh}\,x) = \boldsymbol{cosh}\,x, (\overline{cosech}\,x) = -cosech\,x\,\boldsymbol{coth}\,x$
$(\overline{\boldsymbol{cosh}}\,x) = sh\,x, (\overline{sech}\,x) = -sech\,x\,\boldsymbol{tanh}\,x$
$(\overline{\boldsymbol{tanh}}\,x) = \frac{1}{(\boldsymbol{cosh}^2\,x)} = sech^2\,x$
$(\overline{\boldsymbol{coth}}\,x) = \frac{-1}{(\boldsymbol{sinh}^2\,x)} = -cosech^2\,x$
$[f(x) \overline{\pm} g(x)] = \bar{f}(x) \pm \bar{g}(x)$
$[f\frac{(\overline{x})}{g}(x)] = g(x)\bar{f}(x) - f(x)\bar{g}\frac{(x)}{[g(x)]^2}, g(x) \neq 0$
$y^{(n)} = (uv)^{(n)} = u^{(n)}v + \overset{n}{c}_1 u^{(u-1)} v^{(1)} + \overset{n}{c}_2 u^{(n-2)} v^{(2)} + \overset{n}{c}_3 u^{(n-3)} v^{(3)} + ... + \overset{n}{c}_r u^{(n-r)} v^{(r)} + ... + u v^{(n)}$ نظرية ليبتنز لحاصل ضرب دالتين

Series Expansion Of Trigonometric And Hyperbolic Functions

$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots.,$
$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \frac{x^8}{8!} - \ldots.$
$\tan x = x + \frac{x^3}{3} + 2\frac{x^5}{15} + 17\frac{x^7}{315} + 62\frac{x^9}{2835} + \ldots$
$\cot x = \frac{1}{x} - \frac{x}{3} - \frac{x^3}{45} - 2\frac{x^5}{945} - \frac{x^7}{4725} - \ldots.$
$\sin^{-1} x = x + \frac{x^3}{6} + 3\frac{x^5}{40} + 5\frac{x^7}{112} + \ldots$
$\tan^{-1} x = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \ldots.$
$\cos^{-1} x = \frac{\pi}{2} - \sin^{-1} x$
$\cot^{-1} x = \frac{\pi}{2} - \tan^{-1} x$
$\sinh x = x + \frac{x^3}{3!} + \frac{x^5}{5!} + \frac{x^7}{7!} + \ldots.$
$\cosh x = 1 + \frac{x^2}{2!} + \frac{x^4}{4!} + \frac{x^6}{6!} + \ldots$
$\sinh^{-1} x = x - \frac{x^3}{6} + 3\frac{x^5}{40} - 5\frac{x^7}{112} + \ldots$
$\tanh^{-1} x = x + \frac{x^3}{3} + \frac{x^5}{5} + \frac{x^7}{7} + \ldots$

$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + ...$
$\boldsymbol{coth}^{-1} x = \frac{1}{x} + \frac{1}{(3x^3)} + \frac{1}{(5x^5)} + \frac{1}{(7x^7)} + ..$
$a^x = 1 + \frac{(x\,\boldsymbol{ln}\,a)}{1!} + \frac{(x\,\boldsymbol{ln}\,a)^2}{2!} + \frac{(x\,\boldsymbol{ln}\,a)^3}{3!} + ..$
$\boldsymbol{ln}(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \frac{x^5}{5} - ...$
$\boldsymbol{tanh}\,x = x - \frac{1}{3}x^3 + \frac{2}{15}x^5 - \frac{17}{315}x^7 + ...$
$\boldsymbol{coth}\,x = \frac{1}{x} + \frac{1}{3}x - \frac{1}{45}x^3 + \frac{2}{945}x^5$
$\boldsymbol{cosh}^{-1} x = \boldsymbol{ln}\,2\mathrm{x} - \frac{1}{2} . \frac{1}{(2x^2)} - \frac{[(1)(3)]}{[(2)(4)]} . \frac{1}{(4x^4)} - \frac{[(1)(3)(5)]}{[(2)(4)(6)]} . \frac{1}{(6x^6)} + ..$

Main Formula In Hyperbolic Trigonometry

$sh\, x = \frac{(e^x - e^{-x})}{2}$
$\cosh x = \frac{(e^x + e^{-x})}{2}$
$\tanh x = \frac{(e^x - e^{-x})}{(e^x + e^{-x})}$
$\cos ech\, x = \frac{1}{(sh\, x)}$
$sech\, x = \frac{1}{(\cosh x)}$
$\coth x = \frac{1}{(\tanh x)}$
$\cosh^2 x - sh^2 x = 1$
$1 - \tanh^2 x = sech^2 x$
$1 - \coth^2 x = -\cos ech^2 x$
$sh(-x) = -sh\, x$
$\cosh(-x) = \cosh x$
$\tanh(-x) = -\tanh x$
$sh(x \pm y) = sh\, x \cosh y \pm \cosh x\, sh\, y$
$\cosh(x \pm y) = \cosh x \cosh y \pm sh\, x\, sh\, y$
$\tanh(x \pm y) = \frac{(\tanh x \pm \tanh y)}{(1 \pm \tanh x \tanh y)}$
$sh\, 2\mathrm{x} = 2\, sh\, x \cosh x$

Main Formula In Trigonometry

$\sin^2 x+\cos^2 x=1$
$\tan x=\frac{(\sin x)}{(\cos x)}$
$\cot x=\frac{1}{(\tan x)}=\frac{(\cos x)}{(\sin x)}$
$1+\tan^2 x=sec^2 x=\frac{1}{(\cos^2 x)}$
$\sin x=\sqrt{(1-\cos^2 x)}=\frac{(\tan x)}{(\sqrt{1}+\tan^2 x)}=\frac{1}{(\sqrt{1}+\cot^2 x)}$
$\cos x=\sqrt{(1-\sin^2 x)}=\frac{1}{((\sqrt{1}+\tan^2 x))}=\frac{(\cot x)}{(\sqrt{(1+\cot^2 x)})}$
$\sin(-x)=-\sin x$
$\cos(-x)=\cos x$
$\tan(-x)=-\tan x$
$\sin(x\pm y)=\sin x\cos y\pm\cos x\sin y$
$\cos(x\pm y)=\cos x\cos y\mp\sin x\sin y$
$\tan(x\pm y)=\frac{[\tan x\pm\tan y]}{[1\mp\tan x\tan y]}$
$\cot(x\pm y)=\frac{[\cot x\cot y\mp 1]}{[\cot x\pm\cot y]}$
$\sin x+\sin y=2\sin\frac{(x+y)}{2}\cos\frac{(x-y)}{2}$
$\log_a(xy)=\log_a x+\log_a y, \log(x/y)=\log_a x-\log_a y$ $\log_c^a=\log_b^a\times\log_c^b$

$$\log_a x^n = n \log_a x ; \log_a \sqrt[n]{x} = \frac{1}{n} \log_a x$$

$$\log_{10} x = 0.4343 \log_e x ; \log_e x = 2.303 \log_{10} x$$

Laplace Transform Table

$F(S)$	$F(T), T \geq 0$
1	$\delta(t)$ *unit impulse at* $t=0$
$\frac{1}{s}$	$u_s(t)$ *unit step at* $t=0$
$\frac{1}{s^2}$	$t\,u_s(t)$ *ramp function*
$\frac{1}{s^n}$	$\frac{1}{(n-1)!}t^{(n-1)}$, *n is +ve*
$\frac{1}{s}e^{-as}$	$u_s(t-a)$ *unit step starting at* $t=a$
$\frac{1}{s}(1-e^{-as})$	$u_s(t)-u_s(t-a)$ *rectangular pulse*
$\frac{1}{(s+a)}$	e^{-at} *exponential decay*
$\frac{1}{(s+a)^n}$	$\frac{1}{(n-1)!}t^{(n-1)}e^{-at}$, *n is +ve*
$\frac{1}{(s(s+a))}$	$\frac{1}{a}(1-e^{-at})$
$\frac{1}{[s(s+a)(s+b)]}$	$\frac{1}{ab}[1-\frac{b}{(b-a)}e^{-at}+\frac{a}{(b-a)}e^{-bt}]$
$\frac{(s+\alpha)}{[s(s+a)(s+b)]}$	$\frac{1}{(ab)}[\alpha-\frac{[b(\alpha-a)]}{(b-a)}e^{-at}+\frac{[a(\alpha-b)]}{(b-a)}e^{-bt}]$
$\frac{1}{[(s+a)(s+b)]}$	$\frac{1}{(b-a)}[e^{-at}-e^{-bt}]$
$\frac{s}{[(s+a)(s+b)]}$	$\frac{1}{(a-b)}[a\,e^{-at}-b\,e^{-bt}]$

$\frac{(s+\alpha)}{[(s+a)(s+b)]}$	$\frac{1}{(b-a)}[(\alpha-a)e^{-at}-(\alpha-b)e^{-bt}]$
$\frac{1}{[(s+a)(s+b)(s+c)]}$	$\frac{e^{-at}}{[(b-a)(c-a)]}+\frac{e^{-at}}{[(c-b)(a-b)]}+\frac{e^{-ct}}{[(a-c)(b-c)]}$
$\frac{(s+\alpha)}{[(s+a)(s+b)(s+c)]}$	$\frac{(\alpha-a)}{[(b-a)(c-a)]}e^{-at}+\frac{(\alpha-b)}{[(c-b)(a-b)]}e^{-bt}+\frac{(\alpha-c)}{[(a-c)(b-c)]}e^{-ct}$
$\frac{\omega}{(s^2+\omega^2)}$	$\boldsymbol{sin}\,\omega t$
$\frac{s}{(s^2+\omega^2)}$	$\boldsymbol{cos}\,\omega t$
$\frac{(s+\alpha)}{(s^2+\omega^2)}$	$\frac{\sqrt{(\alpha^2+\omega^2)}}{\omega}\boldsymbol{sin}(\omega t+\phi);\phi=\boldsymbol{tan}^{-1}\frac{\omega}{\alpha}$
$\frac{[s\,\boldsymbol{sin}\theta+\omega\,\boldsymbol{cos}\,\theta]}{(s^2+\omega^2)}$	$\boldsymbol{sin}(\omega t+\theta)$
$\frac{1}{[s(s^2+\omega^2)]}$	$\frac{1}{\omega^2}(1-\boldsymbol{cos}\,\omega t)$
$\frac{(s+\alpha)}{[s(s^2+\omega^2)]}$	$\frac{\alpha}{\omega^2}-\frac{\sqrt{(\alpha^2+\omega^2)}}{\omega^2}\boldsymbol{cos}\,(\omega t+\phi);\phi=\boldsymbol{tan}^{-1}\frac{\omega}{\alpha}$
$\frac{1}{[(s+a)(s^2+\omega^2)]}$	$\frac{e^{-at}}{(a^2+\omega^2)}+\frac{1}{[\omega\sqrt{(\alpha^2+\omega^2)}]}\boldsymbol{sin}(\omega t-\phi);\phi=\boldsymbol{tan}^{-1}\frac{\omega}{\alpha}$
$\frac{1}{[(s+a)^2+b^2]}$	$\frac{1}{b}e^{-at}\boldsymbol{sin}\,bt$
$\frac{1}{[s^2+2\xi\omega_n s+\omega_n^2]}$	$\frac{1}{[\omega_n\sqrt{(1-\xi^2)}]}e^{(-\xi\omega t)}\boldsymbol{sin}\,\omega_n\sqrt{(1-\xi^2 t)}$
$\frac{(s+a)}{[(s+a)^2+b^2]}$	$e^{-at}\boldsymbol{cos}\,bt$
$\frac{(s+\alpha)}{[(s+a)^2+b^2]}$	$\frac{\sqrt{((\alpha-a)^2+b^2)}}{b}e^{-at}\boldsymbol{sin}(bt+\Phi);\phi=\boldsymbol{tan}^{-1}\frac{b}{(\alpha-a)}$

$\frac{1}{[s[(s+a)^2+b^2]]}$	$\frac{1}{(a^2+b^2)}+\frac{1}{(b\sqrt{(a^2+b^2)})}e^{-at}.\mathbf{sin}(bt-\phi),\phi=\mathbf{tan}^{-1}\frac{b}{-a}$
$\frac{1}{[s(s^2+2\xi\omega_n s+\omega_n^2)]}$	$\frac{1}{\omega_n^2}-\frac{1}{(\omega_n^2\sqrt{(1-\xi^2)})}e^{(-\xi\omega_n t)}.\mathbf{sin}(\omega_n\sqrt{(1-\xi^2 t+\phi)});\phi=\mathbf{cos}^{-1}\xi$
$\frac{(s+\alpha)}{[s[(s+a)^2+b^2]]}$	$\frac{\alpha}{(a^2+b^2)}+\frac{1}{b}\sqrt{(\frac{[(\alpha-a)^2+b^2]}{(a^2+b^2)})}.e^{-at}\mathbf{sin}(bt+\phi);\phi=\mathbf{tan}^{-1}\frac{b}{(\alpha-a)}-\mathbf{tan}^{-1}\frac{b}{-a}$
$\frac{1}{[[(s+c)](s+a)^2+b^2]}$	$\frac{e^{-ct}}{[(c-a)^2+b^2]}+\frac{[e^{-at}\mathbf{sin}(bt-\phi)]}{[b\sqrt{((c-a)^2+b^2)}]};\phi=\mathbf{tan}^{-1}\frac{b}{(c-a)}$
$\frac{1}{[s^2(s+a)]}$	$\frac{1}{a^2}(at-1+e^{-at})$
$\frac{1}{[s(s+a^2)]}$	$\frac{1}{a^2}(1-e^{-at}-at\,e^{-at})$
$\frac{1}{[s(s+c)[(s+a)^2+b^2]]}$	$\frac{1}{[c(a^2+b^2)]}-\frac{e^{-ct}}{[c[(c-a)^2+b^2]]}+\frac{(e^{-at}\mathbf{sin}(bt-\phi))}{[b\sqrt{(a^2+b^2)}\sqrt{((c-a)^2+b^2)}]}$ $\phi=\mathbf{tan}^{-1}\frac{b}{-a}+\mathbf{tan}^{-1}\frac{b}{(c-a)}$
$\frac{(s+\alpha)}{[s(s+c)[(s+a)^2+b^2]]}$	$\frac{\alpha}{[c(a^2+b^2)]}-\frac{[(c-\alpha)e^{-ct}]}{[c[(c-a)^2+b^2]]}+\frac{\sqrt{((\alpha-a)^2+b^2)}}{[b\sqrt{(a^2+b^2)}\sqrt{((c-a)^2+b^2)}]}$ $.e^{-at}\mathbf{sin}(bt+\phi);\phi=\mathbf{tan}^{-1}\frac{b}{(\alpha-a)}-\mathbf{tan}^{-1}\frac{b}{-a}-\mathbf{tan}^{-1}\frac{b}{(c-a)}$

Z − Transform Table

$e(t)$	$E(Z)$
$\delta(t)$	1
$\delta(t-nT)$	z^{-n}
$U_s(t)$	$\frac{z}{(z-1)}$
t	$\frac{Tz}{(z-1)^2}$
t^2	$T^2 z \frac{(z+1)}{(z-1)^3}$
$t^{(n-1)}$	$\lim_{a\to 0} (-1)^{(n-1)} \frac{\partial^{(n-1)}}{(\partial a^{(n-1)})} [\frac{z}{(z-e^{(-aT)})}]$
e^{-at}	$\frac{z}{(z-e^{-at})}$
$\frac{1}{(b-a)}(e^{-at}-e^{-bt})$	$\frac{1}{(b-a)}[\frac{z}{(z-e^{-at})}-\frac{z}{(z-e^{-bt})}]$
$\frac{1}{a}(u_s(t)-e^{-at})$	$\frac{1}{a}[\frac{((1-e^{-aT})z)}{((z-1)(z-e^{-aT}))}]$
$\frac{1}{a}[t-\frac{(1-e^{-at})}{a}]$	$\frac{1}{a}[\frac{Tz}{(z-1)^2}-\frac{((1-e^{-aT})z)}{[a(z-1)(z-e^{-aT})]}]$

تم بحمد الله وتوفيقه

Email

memory_code_84@yahoo.com

السفياني