$D\,x^7 = 7x^6$

$D\sqrt{x} = D\,x^{\frac{1}{2}} = \frac{1}{2}x^{-\frac{1}{2}}$

$D\,\sin(x) = +\cos(x)$

$D\,\cos(x) = -\sin(x)$

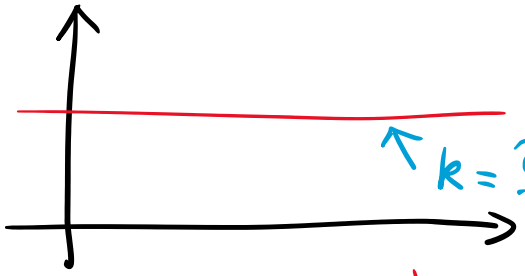
$D\,\frac{3}{x^2} = D\,3x^{-2} = 3\cdot(-2)\,x^{-3} = -6x^{-3}$

$D\,e^x = e^x$

$D\,h(x) = \frac{1}{x}$

$D\,e^{x^5} = e^{x^5}\cdot 5x^4$

$D\,\ln(\sin(x)) = \frac{1}{\sin(x)}\cdot\cos(x)$



KASVUNOPEUS = KULMAKERROIN

$D\,\text{VAKIO} = 0$

$D\,7 = D\,7x^0 =$

$D\,x^7 = 7x^6$

$D\,3x^{-2} = 3(-2)\,x^{-3}$

$D\,7x^0 = 7\cdot 0\cdot \quad = 0$

Potenssin derivaatta	Trigonometristen funktioiden derivaatat	Arkusfunktioiden derivaatat
$Dx^n = nx^{n-1}$, missä $n \in \mathbb{Z}$	$D\sin x = \cos x$	$D\arcsin x = \frac{1}{\sqrt{1-x^2}}$
$D\sqrt{x} = \frac{1}{2\sqrt{x}}$ [2]	$D\cos x = -\sin x$	$D\arccos x = -\frac{1}{\sqrt{1-x^2}}$
$D\sqrt[3]{x} = \frac{1}{3\sqrt[3]{x^2}}$	$D\tan x = \frac{1}{\cos^2 x} = 1+\tan^2 x$	$D\arctan x = \frac{1}{1+x^2}$
$D\sqrt[n]{x} = \frac{1}{n\sqrt[n]{x^{n-1}}}$	$D\cot x = -\frac{1}{\sin^2 x} = -1-\cot^2 x$	$D\operatorname{arccot} x = -\frac{1}{1+x^2}$
Eksponenttifunktion derivaatta	**Hyperbolisten funktioiden derivaatat**	**Hyperbolisten käänteisfunktioiden eli area funktioiden derivaatat**
$De^x = e^x$	$D\sinh x = \cosh x$	$D\ \operatorname{arsinh} x = \frac{1}{\sqrt{x^2+1}}$
$Da^x = a^x \ln a$, missä $a > 0$	$D\cosh x = \sinh x$	$D\ \operatorname{arcosh} x = \frac{1}{\sqrt{x^2-1}}$

$Da^x = a^x \ln a$, missä $a > 0$	$D\cosh x = \sinh x$	$D\ \operatorname{arcosh} x = \frac{1}{\sqrt{x^2-1}}$
	$D\tanh x = \frac{1}{\cosh^2 x}$	$D\ \operatorname{artanh} x = \frac{1}{1-x^2}$
Logaritmifunktioiden derivaatat		
$D\ln\lvert x\rvert = \frac{1}{x}$		
$D\log_a \lvert x\rvert = \frac{1}{x\ln a}$, missä $a > 0$ ja $a \neq 1$		

Säännön nimi	Derivointisääntö
Vakion derivaatta	$Dc = 0$, kun c on vakio.[4]
Vakion siirto	$Dcf(x) = cDf(x)$ [1][4]
Summan derivaatta	$D(f(x) + g(x)) = Df(x) + Dg(x)$ [1][10][4]
Tulon derivaatta	$D(f(x)g(x)) = g(x)Df(x) + f(x)Dg(x)$ [1][12][13][4]
Funktion potenssin derivaatta	$Df(x)^n = nf(x)^{n-1}f'(x)$ [12][14]
Osamäärän derivaatta	$D\frac{f(x)}{g(x)} = \frac{g(x)Df(x) - f(x)Dg(x)}{g(x)^2}$ [14][13][4]
Yhdistetyn funktion derivaatta	$Dg(f(x)) = g'(f(x))f'(x)$ [4]
Käänteisfunktion derivaatta	$(f^{-1})'(f(x)) = \frac{1}{f'(x)}$, jossa f^{-1} on f:n käänteisfunktio.[4]

e^{x^5}

$\ln(\sin(x))$

$D\ x^5 \ln(x)$

$= 5x^4 \ln(x) + x^5 \cdot \frac{1}{x}$

$= 5x^4 \ln(x) + x^4 \qquad = \frac{x^5}{x} = x^4$

Osamäärän derivaatta $\quad D\frac{f(x)}{g(x)} = \frac{g(x)Df(x) - f(x)Dg(x)}{g(x)^2}$

$D\ \frac{x^5}{\sin(x)} = \frac{5x^4\sin(x) - x^5\cos(x)}{\sin(x)^2}$

$D\ \frac{f(x)}{g(x)^1} = D\ f(x)(g(x))^{-1} \qquad \frac{1}{x^2} = x^{-2}$

$= f'(x)(g(x))^{-2}g(x)' + f(x)\cdot(-1)(g(x))^{-2}g'(x)$

$$= f'(x)\,(g(x))^{-1}\,g(x)' + f(x)\cdot(-1)\,(g(x))^{-2}\,g'(x)$$

$$= \frac{f'(x)\,g(x) - f(x)\,g'(x)}{g(x)^2}$$

INTEGROINTI ON DERIVOINNIN KÄÄNTEISOPERAATIO

$$D\,x^7 = 7x^6 \qquad (-1)$$

$$\int x^5\,dx = \frac{x^6}{6}$$

$$\int x^3\,dx = \frac{x^4}{4}$$

$$D\,e^x = e^x \qquad \int e^x\,dx = e^x$$

$$\int x^2\,dx = \frac{x^3}{3}$$

$$\int e^{2x}\,dx = e^{2x}$$

$$D\,e^{2x} = e^{2x}\cdot \underbrace{D(2x)}_{=2}$$

$$De^{2x} = 2e^{2x}$$

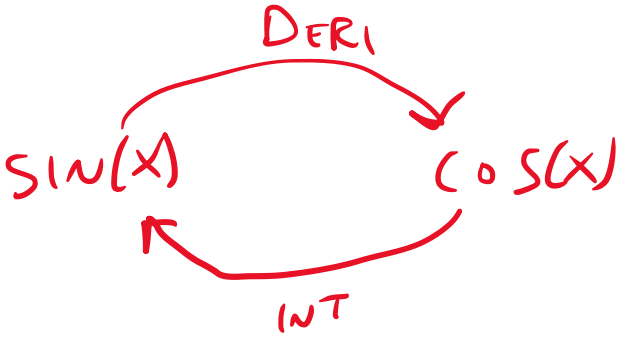
$$\int e^{2x}\,dx = \frac{e^{2x}}{2}$$

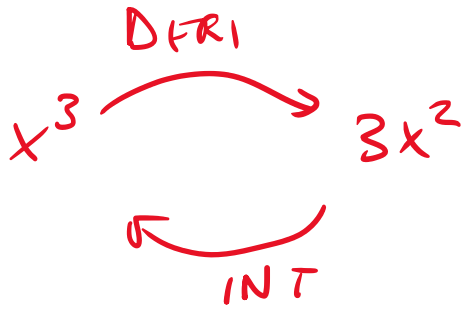
$$\int e^{5x}\,dx = \frac{e^{5x}}{5}$$

$$D\,\sin(x) = \cos(x) \qquad \int \cos(x)\,dx = \sin(x)$$

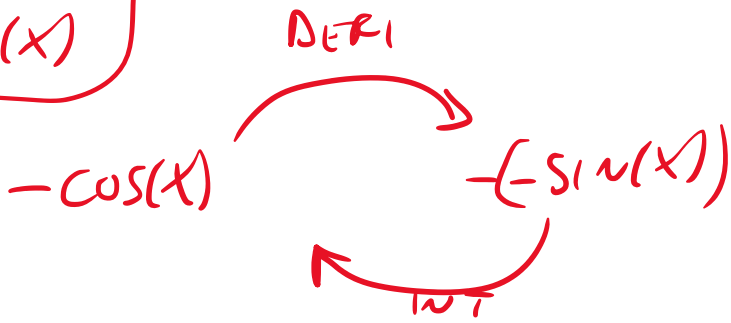
$$D\,\cos(x) = -\sin(x)$$

DERI DERI

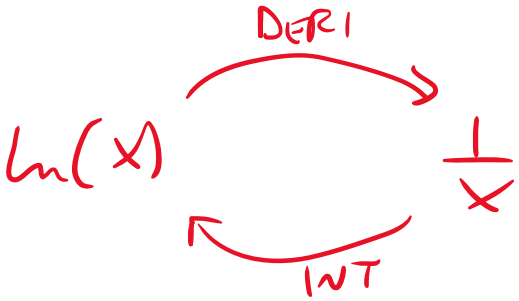


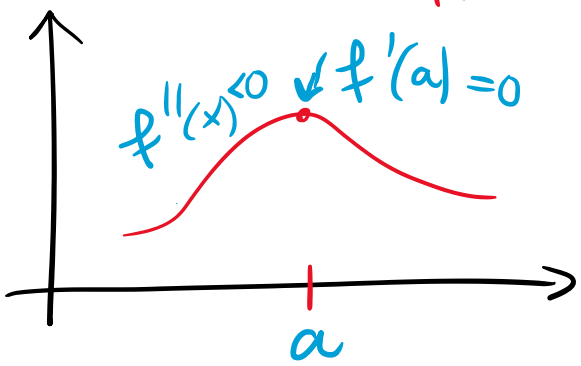


$$\int \sin(x)\,dx = -\cos(x)$$



$$D\ln(x) = \frac{1}{x} \qquad \int \frac{1}{x}\,dx = \ln(x)$$





MISTÄ TIETÄÄ ONKO MAKSIMI/MINIMI ?

① KUVA / LUONNOS

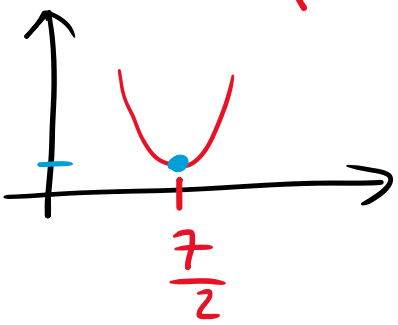
② PISTEESSÄ a

MAKSIMI, JOS
$\begin{cases} f'(a) = 0 \\ f''(a) < 0 \end{cases}$

MINIMI, JOS
$\begin{cases} f'(a) = 0 \\ f''(a) > 0 \end{cases}$

ESIM. $f(x) = x^2 - 7x$ POLYNOMI

ETSI MINIMI.



$f(x) = x^2 - 7x^1$

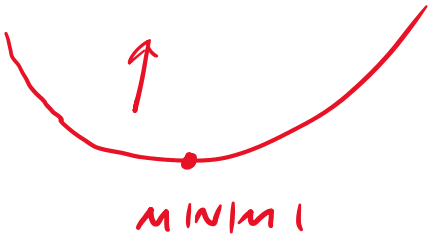
$f'(x) = 2x - 7$

$f''(x) = 2 > 0$

$2x - 7 = 0 \quad \| +7$

$2x = 7 \quad \| :2$

$x = \frac{7}{2} = 3.5$



$f(x) = x^2 - 7x$

$f\left(\frac{7}{2}\right) = \left(\frac{7}{2}\right)^2 - 7 \cdot \frac{7}{2} = \frac{49}{4} - \underbrace{\frac{49}{2}}_{\frac{2 \cdot 49}{4}}$

$= -\frac{49}{4}$

HARJOITTELE T

- MINIMI & MAKSIMI
- INTEGROINTI