$$\left.\begin{array}{l} h(1) = \underbrace{f(1)}_{<0} - \underbrace{g(1)}_{>0} < 0 \\ h \text{ jatkuva välillä } [0,1] \end{array}\right\} \Rightarrow h\text{:lle on ainakin 1 0-kohta välillä väl. }]0,1[$$

$\Rightarrow$ väite

11. Tulon ja osamäärän derivaatta

$$\boxed{\begin{array}{l} D\,(f(x)\cdot g(x)) = f'(x)\cdot g(x) + f(x)\cdot g'(x) \\ D\,\dfrac{f(x)}{g(x)} = \dfrac{f'(x)\cdot g(x) - f(x)\cdot g'(x)}{(g(x))^2} \end{array}}$$

TULON DERIVAATTA

OSAMÄÄRÄN – " –

11, 2 $h(x) = \overbrace{\frac{1}{5}x^6}^{f(x)}\cdot\overbrace{(5x-2x^4)}^{g(x)}$

$h'(x) = \frac{6}{5}x^5\cdot(5x-2x^4) + \frac{1}{5}x^6\cdot(5-8x^3)$

$h'(-1) = \frac{6}{5}\cdot(-1)^5\,(5\cdot(-1)-2(-1)^4) + \frac{1}{5}(-1)^6\,(5-8\cdot(-1)^3)$

$= \frac{6}{5}\cdot(-1)\,(-5-2\cdot 1) + \frac{1}{5}\cdot 1\cdot(5-8\cdot(-1))$

$= -\frac{6}{5}\cdot(-7) + \frac{1}{5}\cdot 13 = \frac{42}{5}+\frac{13}{5} = \frac{55}{5} = \underline{11}$

11, 4 $f(x) = \dfrac{4x}{x^2-4}$

$f'(x) = \dfrac{4\cdot(x^2-4) - 4x\cdot 2x}{(x^2-4)^2} = \underline{\dfrac{-4x^2-16}{(x^2-4)^2}}$

$f'(0) = \dfrac{-4\cdot 0^2-16}{(0^2-4)^2} = \dfrac{-16}{16} = \underline{-1}$

11, 9

$r(x) = \dfrac{2-x}{x^3}$, $x \neq 0$

$r'(x) = \dfrac{-1\cdot x^3 - (2-x)\cdot 3x^2}{(x^3)^2} = \dfrac{2x^3-6x^2}{x^6} = \dfrac{\cancel{x^2}(2x-6)}{x^{\cancel{6}4}} = 0 \quad |\cdot x^4$

$\Leftrightarrow 2x-6=0 \quad \Leftrightarrow \underline{x=3}$ %

11, 17 $g(x) = \dfrac{x^3}{\underbrace{x^2+5}_{\geq 0}}$, $x \in \mathbb{R}$, g jatk. ja deriv. $\mathbb{R}$:ssä