

### 11.5A Määritä funktion $f$ derivaattafunktion

nollakohdat.

a)  $f(x) = (x^2 - 3x)^4$

b)  $f(x) = \frac{x^2}{x-1}$

c)  $f(x) = x^3 e^x$

6.  $Dg(f(x)) = g'(f(x)) \cdot f'(x)$

9.  $D(f(x))^n = n(f(x))^{n-1} \cdot f'(x)$

a) yhdistetty funktio (missä  $f(x) = x^2 - 3x$ , ulko  $g(x) = x^4$ )

$f'(x) = 2x - 3$       $g'(x) = 4x^3$

$$\left( (x^2 - 3x)^4 \right)' = \underbrace{4(x^2 - 3x)^3}_{g'(f(x))} \cdot \underbrace{(2x - 3)}_{f'(x)} \quad (= 0, \text{ kun } x^2 - 3x = 0 \vee 2x - 3 = 0)$$

$x(x-3) = 0 \vee 2x = 3$   
 $x = 0 \vee x = 3$       $x = \frac{3}{2}$

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

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

Mj.  $x \neq 1$  !  
 $x = 0 \vee x - 3 = 0$   
 $x = 3$   
 $x = 0 \vee x = 2$

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

$f'(x) = 3x^2 e^x + x^3 e^x = e^x(3x^2 - x^3)$  ( $= 0$ , kun  $3x^2 - x^3 = 0$ )  
 $x^2(3-x) = 0 \Leftrightarrow x = 0 \vee 3-x = 0$

$x = 0 \vee x = 3$