Esim. a) $D x^{10} \overset{2.}{=} 10x^9$

b) $D(3x^5) \overset{3.}{=} 3\, D x^5 \overset{2.}{=} 3\cdot 5x^4 = 15x^4$

c) $D(2x^3 - 7x^2 + 4x - 5) \overset{4.}{=} D(2x^3)+D(-7x^2)+D(4x)+\underbrace{D(-5)}_{\overset{1.}{=}0}$

$\overset{3.}{=} 2\cdot Dx^3 - 7\,Dx^2 + 4\,Dx$

$\overset{2.}{=} 2\cdot 3x^2 - 7\cdot 2x^1 + 4\cdot 1\cdot \underbrace{x^0}_{=1}$

$= 6x^2 - 14x + 4$

Esim. $f(x) = x^3 + 3x^2 - 9x + 4$

Laske $f'(-2)$ ja määritä derivaatan 0-kohdat.

Ratk. $f'(x) = 3x^2 + 6x - 9 = 0 \iff x = \begin{cases}1\\-3\end{cases}$ derivaatan 0-kohdat

$f'(-2) = 3\cdot(-2)^2 + 6\cdot(-2) - 9 = -9$

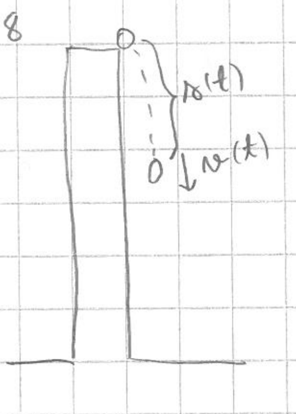
6.4 a) $f(x) = 2x^3(8 - 4x + x^2) = 16x^3 - 8x^4 + 2x^5$

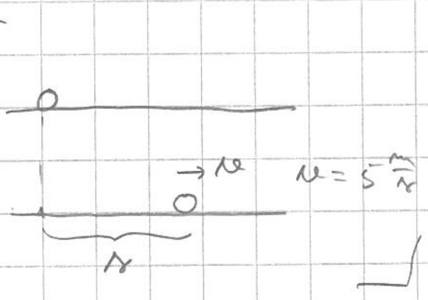
$f'(x) = 48x^2 - 32x^3 + 10x^4$

b) $g(x) = 3t(t+4)^2 = 3t(t^2+8t+16) = 3t^3 + 24t^2 + 48t$

$g'(x) = 9t^2 + 48t + 48$

6.8 $s(t) = 4{,}9t^2$ (m)





Nopeus on kuljetun matkan muutosnopeus eli derivaatta

$v(t) = s'(t) = 9{,}8t \ (\frac{m}{s})$

a) $v(2) = 9{,}8\cdot 2 = 19{,}6 \approx 20 \ (\frac{m}{s})$

b) $v(3) = 9{,}8\cdot 3 = 29{,}4 \approx 29 \ (\frac{m}{s})$

$s(3) = 4{,}9\cdot 3^2 = 44{,}1$ (m) ← ei ole vielä maassa

6.19 $f(x) = ax^2 + bx + c \Rightarrow f'(x) = 2ax + b \Rightarrow f''(x) = 2a$

f:n 2. toinen derivaatta (eli tupladerivaatta "hutti Mustonen")

$$\begin{cases} f(2) = a\cdot 2^2 + b\cdot 2 + c = 4 \\ f'(2) = 2a\cdot 2 + b = -2 \quad \leftarrow \text{sij.} \\ f''(2) = 2a = 6 \quad |:2 \iff a = 3 \end{cases}$$

$\Rightarrow 4\cdot 3 + b = -2 \iff b = -14$

$\Rightarrow 3\cdot 4 + (-14)\cdot 2 + c = 4 \iff c = 20$

Siis $f(x) = 3x^2 - 14x + 20$