Derivoimissääntöjä:

1. $Dk = 0$, k vakio
2. $Dx^n = nx^{n-1}$
3. $D(k \cdot f(x)) = k \cdot Df(x) = kf'(x)$, k vakio
4. $D(f(x) + g(x)) = Df(x) + Dg(x) = f'(x) + g'(x)$

Esim. a) $Dx^6 \overset{2.}{=} 6x^5$

b) $D(3x^4) \overset{3.}{=} 3Dx^4 \overset{2.}{=} 3 \cdot 4x^3 = 12x^3$

c) $D(2x^3 - 4x + 1) \overset{4.}{=} D(2x^3) + D(-4x) + D1$
$\overset{3.}{=} 2 \cdot Dx^3 - 4Dx + 0$
$\overset{2.}{=} 2 \cdot 3x^2 - 4 \cdot 1 \underbrace{x^0}_{=1}$
$= 6x^2 - 4$

Esim. $f(x) = x^3 + 3x^2 - 9x + 4$.
Laske $f'(-2)$ ja määritä derivaatan 0-kohdat.

Ratk. $f'(x) = 3x^2 + 6x - 9$
$f'(-2) = 3 \cdot (-2)^2 + 6 \cdot (-2) - 9 = 12 - 12 - 9 = -9$
derivaatan 0-kohdat: $f'(x) = 3x^2 + 6x - 9 = 0 \Leftrightarrow x = \begin{cases} -3 \\ 1 \end{cases}$

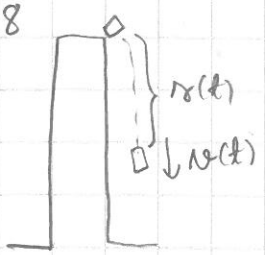
6.3 a) $f(x) = -2x^3 + x^2 - x + 1$
$f'(x) = -6x^2 + 2x - 1$
$f'(2) = -6 \cdot 2^2 + 2 \cdot 2 - 1 = -21$

b) $f(t) = 125t^2 - 110t$
$f'(t) = 250t - 110$
$f'(2) = 250 \cdot 2 - 110 = 390$

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) $g(t) = 3t(t+4)^2 = 3t(t^2 + 8t + 16) = 3t^3 + 24t^2 + 48t$
$g'(t) = 9t^2 + 48t + 48$

6.8



$s(t) = 4{,}9t^2$ (m)
Nopeus on kuljetun matkan muutosnopeus eli derivaatta
$v(t) = s'(t) = 9{,}8t \left(\frac{m}{s}\right)$

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

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