

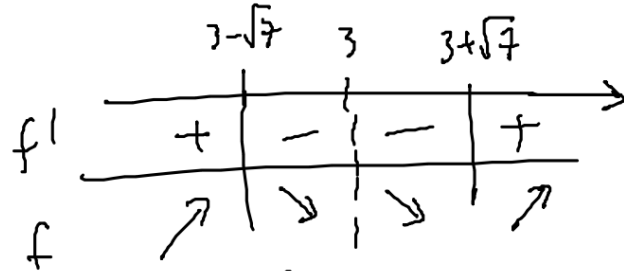
Asymptootit

346. $g(x) = \frac{3x^2 - 2x}{x - 3}$

$x \neq 3$
 pystys. asympt.
 $x = 3$

EN KYSY
 KOKKESSA!

Deriv. nolake: $g'(x) = 0 \rightarrow x = 3 \pm \sqrt{7}$ $\approx \left. \begin{matrix} 0,4 \text{ tai } 5,6 \\ 4 = 0,1 \end{matrix} \right\} 32$



$\lim_{x \rightarrow \infty} \frac{3x^2 - 2x}{x - 3} = \lim_{x \rightarrow \infty} \frac{3x - 2}{1 - \frac{3}{x}} = \frac{\infty}{1} = \infty$

Ei vaakas.
 asympt.

$\lim_{x \rightarrow -\infty} = \dots = -\infty$

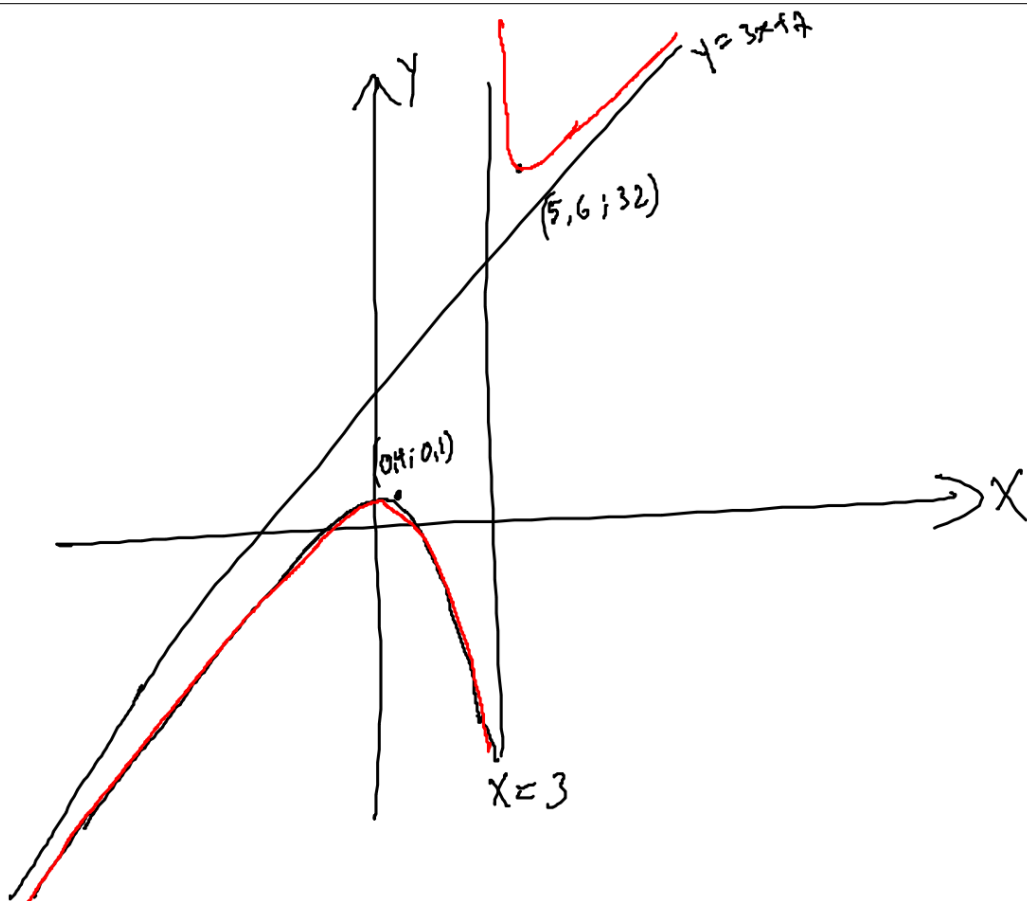
viivo asympt. $x \rightarrow 3$

$$\begin{array}{r} 3x + 7 \\ \hline 3x^2 - 2x \\ - 3x^2 + 9x \\ \hline 7x \end{array}$$

jako: 21

$$\frac{3x^2 - 2x}{x - 3} = 3x + 7 + \frac{21}{x - 3}$$

viivo asympt. $\downarrow 0$



Lukujonon raja-arvon määrittäminen

- Jos $a_n \rightarrow a$ kun $n \rightarrow +\infty$
niin lukujonolla on raja-arvo $= a$

- Jos $a_n \rightarrow \pm \infty$ kun $n \rightarrow +\infty$
niin silloin a_n hajaantuu

Esim. a) $a_n = 2n \rightarrow \infty$ kun $n \rightarrow \infty$ eli
 a_n hajaantuu

$$b) a_n = \frac{1-2n}{3n} = \frac{\frac{1}{n} - 2}{3} \rightarrow \frac{0-2}{3} = -\frac{2}{3} \text{ kun } n \rightarrow \infty$$

413. $\lim_{n \rightarrow \infty} \left(\left(\frac{5}{n} - n \right)^2 - n^2 \right)$

$$= \lim_{n \rightarrow \infty} \left(\frac{25}{n^2} - 10 + \cancel{n^2} - \cancel{n^2} \right) = \lim_{n \rightarrow \infty} \left(\frac{25}{n^2} - 10 \right) = -10$$

418. a) $\lim_{n \rightarrow \infty} \frac{2n-3}{\sqrt{n}-1} = \lim_{n \rightarrow \infty} \frac{2\sqrt{n} - \frac{3}{\sqrt{n}}}{1 - \frac{1}{\sqrt{n}}} = \frac{\infty}{1} = \infty$
häjäättyn

b) $\lim_{n \rightarrow \infty} \frac{4n-9}{2\sqrt{n}+3} = \lim_{n \rightarrow \infty} \frac{4\sqrt{n} - \frac{9}{\sqrt{n}}}{2 + \frac{3}{\sqrt{n}}} = \frac{\infty}{2} = \infty$
häjäättyn

c) $\lim_{n \rightarrow \infty} \frac{2\sqrt{n}+3}{4n-9} = \lim_{n \rightarrow \infty} \frac{2 + \frac{3}{\sqrt{n}}}{4\sqrt{n} - \frac{9}{\sqrt{n}}} = \frac{2}{\infty} = 0$
on vakava

496. $\frac{1}{2}, \frac{4}{3}, \frac{7}{4}, \frac{10}{5}, \frac{13}{6}, \dots$

$$a_n = \frac{3n-2}{n+1}$$

$$\lim_{n \rightarrow \infty} \frac{3n-2}{n+1} = \lim_{n \rightarrow \infty} \frac{3 - \frac{2}{n} \rightarrow b}{1 + \frac{1}{n} \rightarrow d} = 3$$

X	Y
1	1
2	4
3	7
4	10

↓
Suoran yhtälö
 $3x-2$

$$\left| \frac{3n-2}{n+1} - 3 \right| < 0,001$$

$$\left| \frac{3n-2-3n-3}{n+1} \right| = \frac{5}{n+1} < 0,001$$

$$n > 4999$$

V: 5000:sta termistä
lähemmäs