i) Lasketaan $f(a)$ jos mahdollista

ii) Jos ei mahdollista (esim. tilanne $\frac{0}{0}$), muutetaan (supistetaan, laavennetaan, ...) $f(x)$ muotoa johon voidaan sijoittaa $x = a$

<u>Esim.</u> a) $$\lim_{x\to -2} \frac{3x^2+12x+12}{6x+12} \overset{\left(\frac{0}{0}\right)}{=} \lim_{x\to -2} \frac{3(x^2+4x+4)}{6(x+2)} \overset{\left(\frac{0}{0}\right)}{=} \lim_{x\to -2} \frac{\cancel{3}(x+2)^{\cancel{2}}}{\underset{2}{\cancel{6}}\cancel{(x+2)}}$$

$$= \lim_{x\to -2} \frac{x+2}{2} = \frac{-2+2}{2} = \frac{0}{2} = \underline{0}$$

b) $$\frac{x^2+x-6}{x^2+3x} \overset{\left(\frac{0}{0}\right)}{=} \frac{1\cdot(x-2)\cancel{(x-(-3))}}{x\cancel{(x+3)}} = \frac{x-2}{x} \xrightarrow{x\to -3} \frac{-3-2}{-3} = \frac{-5}{-3} = \underline{\frac{5}{3}}$$

$\ulcorner\ x^2+x-6=0 \iff x=\begin{cases} 2 \\ -3 \end{cases}\ \lrcorner$

2,4 a) $$\lim_{x\to 6} \frac{x^2-6x}{6-x} \overset{\left(\frac{0}{0}\right)}{=} \lim_{x\to 6} \frac{x(x-6)}{6-x} = \lim_{x\to 6} \frac{x\cancel{(x-6)}}{-\cancel{(x-6)}} = \lim_{x\to 6}(-x) = \underline{-6}$$

b) $$\frac{x^2-16}{x-4} \overset{\left(\frac{0}{0}\right)}{=} \frac{x^2-4^2}{x-4} = \frac{\cancel{(x-4)}(x+4)}{\cancel{x-4}} = x+4 \xrightarrow{x\to 4} 4+4 = \underline{8}$$

2,6 a) $$\lim_{x\to -1} \frac{x^2+2x+1}{x^2-\underset{1^2}{1}} \overset{\left(\frac{0}{0}\right)}{=} \lim_{x\to -1} \frac{(x+1)^{\cancel{2}}}{(x-1)\cancel{(x+1)}} = \lim_{x\to -1} \frac{x+1}{x-1} = \frac{-1+1}{-1-1} = \frac{0}{-2} = \underline{0}$$

b) $$\lim_{x\to 1} \frac{x^4-1}{2-2x} \overset{\left(\frac{0}{0}\right)}{=} \lim_{x\to 1} \frac{(x^2)^2-1^2}{2(1-x)} = \lim_{x\to 1} \frac{(x^2-1^2)(x^2+1)}{2(1-x)} = \lim_{x\to 1} \frac{\cancel{(x-1)}(x+1)(x^2+1)}{-2\cancel{(x-1)}}$$

$$= \lim_{x\to 1} \frac{(x+1)(x^2+1)}{-2} = \frac{(1+1)\cdot(1^2+1)}{-2} = \frac{4}{-2} = \underline{-2}$$

2,20 a) $\lim_{x\to -2} \frac{2x^2+x+a}{x+2}$ on olemassa

Koska nimittäjä $x+2 \to 0$, myös osoittaja $\to 0$ (rajalle on oltava tilanne $\frac{0}{0}$, jos olisi esim. $\frac{5}{0} = \pm\infty$ ja raja-arvo ei olisi olemassa!)

$x=-2$: $2\cdot(-2)^2-2+a=0 \iff 8-2+a=0 \iff \underline{a=-6}$

Tällöin $$\frac{2x^2+x-6}{x+2} \overset{\left(\frac{0}{0}\right)}{=} \frac{2\cancel{(x-(-2))}(x-\frac{3}{2})}{\cancel{x+2}} = 2(x-\tfrac{3}{2}) = 2x-3 \xrightarrow{x\to -2} 2\cdot(-2)-3 = \underline{-7}$$

$\ulcorner\ 2x^2+x-6=0 \iff x=\begin{cases} -2 \\ \frac{3}{2} \end{cases}$