$$\begin{aligned}\lim_{x\to a} f(x) &= \lim_{x\to a} a_n x^n + a_{n-1}x^{n-1} + ... + a_1 x + a_0\\ &= \lim_{x\to a}[a_n x^n] + \lim_{x\to a}[a_{n-1}x^{n-1}] + ... + \lim_{x\to a}[a_1 x] + \lim_{x\to a}[a_0]\\ &= a_n \lim_{x\to a}[x^n] + a_{n-1}\lim_{x\to a}[x^{n-1}] + ... + a_1 \lim_{x\to a}[x] + \lim_{x\to a} a_0\\ &= a_n(\lim_{x\to a} x)^n + a_{n-1}(\lim_{x\to a} x)^{n-1} + ... + a_1(\lim_{x\to a} x) + a_0\\ &= a_n a^n + a_{n-1}a^{n-1} + ... + a_1 a + a_0 = f(a)\end{aligned}$$

Example Find the $\lim_{x\to 5}(2x^2 - 3x + 4)$.
We will use the same steps as we did in the proof of the above Corollary.

$$\begin{aligned}\lim_{x\to 5}(2x^2 - 3x + 4) &= \lim_{x\to 5} 2x^2 - \lim_{x\to 5} 3x + \lim_{x\to 5} 4 \text{ by Law 1}\\ &= 2\lim_{x\to 5} x^2 - 3\lim_{x\to 5} x + \lim_{x\to 5} 4 \text{ by Law 2}\\ &= 2[\lim_{x\to 5} x]^2 - 3\lim_{x\to 5} x + \lim_{x\to 5} 4 \text{ by Law 5}\\ &= 2(5)^2 - 3(5) + 4 = 39\end{aligned}$$

Example Find the $\lim_{x\to -2} \frac{x^3+2x^2-1}{5-3x}$.
First note that $\lim_{x\to -2} 5 - 3x = 5 - 3\lim_{x=to-2} x = 11 \neq 0$. So we may use the Law 4 for quotients.

$$\begin{aligned}\lim_{x\to -2}\frac{x^3 + 2x^2 - 1}{5 - 3x} &= \frac{\lim_{x\to -2} x^3 + 2x^2 - 1}{\lim_{x\to -2} 5 - 3x}\\ &= \frac{(-2)^3 + 2(-2)^2 - 1}{11} = \frac{-1}{11}\end{aligned}$$

Theorem If f is a rational function and "a" is in the domain of f, then $\lim_{x\to a} f(x) = f(a)$.

After the Example above the proof of this theorem should be clear. Let's see what happens if "a" is not in the domain of our rational function.