178 (polynomial) You are given n: *nat* , c: n**rat* , x: *rat* and variable y: *rat* . c is a string of coefficients of a polynomial ("of degree n–1") to be evaluated at x . Write a program for

$$y' = \Sigma i\colon 0,..n\cdot c_i \times x^i$$

After trying the question, scroll down to the solution.

§ $y' = (\Sigma i\colon 0,..n\cdot c_i \times x^i) \wedge t'=t+n \Leftarrow$

$y:= 0.\ k:= 0.\ y' = y + (\Sigma i\colon k,..n\cdot c_i \times x^i) \wedge t'=t+n-k$

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if $k=n$ **then** *ok*

else $y:= y + c_k \times x^k.\ k:= k+1.\ t:= t+1.\ y' = y + (\Sigma i\colon k,..n\cdot c_i \times x^i) \wedge t'=t+n-k$ **fi**

A more efficient way (in real time), not using exponentiation, (and with less floating-point roundoff error, if you're stuck with floating-point,) is Horner's Rule, as follows:

$y' = (\Sigma i\colon 0,..n\cdot c_i \times x^i) \wedge t'=t+n \Leftarrow$

$y:= 0.\ k:= n.\ y' = y \times x^k + (\Sigma i\colon 0,..k\cdot c_i \times x^i) \wedge t'=t+k$

$y' = y \times x^k + (\Sigma i\colon 0,..k\cdot c_i \times x^i) \wedge t'=t+k \Leftarrow$

if $k=0$ **then** *ok*

else $k:= k-1.\ y:= y \times x + c_k.\ t:= t+1.\ y' = y \times x^k + (\Sigma i\colon 0,..k\cdot c_i \times x^i) \wedge t'=t+k$ **fi**