391 For each of the following fixed-point equations, what does recursive construction yield? Does it satisfy the fixed-point equation?

(a) $P \;=\; \S n\text{: } nat\cdot\ n{=}0 \wedge P{=}null \;\vee\; n\text{: } P{+}1$

(b) $Q \;=\; \S x\text{: } xnat\cdot\ x{=}0 \wedge Q{=}null \;\vee\; x\text{: } Q{+}1$

After trying the question, scroll down to the solution.

(a) $P = \S n: nat\cdot n=0 \wedge P=null \vee n: P+1$

§ $P_0 = null$

$P_{n+1} = n$

$P_\infty = \infty$ which does not satisfy the fixed-point equation.

$\S x\cdot \Updownarrow n\cdot x: P_n = null$ which does not satisfy the fixed-point equation either.

Maybe there isn't any solution.

(b) $Q = \S x: xnat\cdot x=0 \wedge Q=null \vee x: Q+1$

§ $Q_0 = null$

$Q_{n+1} = n$

$Q_\infty = \infty$ which does satisfy the fixed-point equation.

$\S x\cdot \Updownarrow n\cdot x: Q_n = null$ which does not satisfy the fixed-point equation.