Exercise 4 solution: We use induction to show that $\pi F^n(x) = f^n\pi(x)$ for all $x \in \mathbf{R}$ and all positive integers n . Let $x \in \mathbf{R}$. The $n = 0$ case is $\pi(x) = \pi(x)$. Suppose $\pi F^n(x) = f^n\pi(x)$ for some $n > 0$. Then $\pi F^{n+1}(x) = \pi F(F^n(x)) = f\pi(F^n(x)) = f(f^n(\pi(x)) = f^{n+1}\pi(x)$. Thus F^n is a lift of f^n for all positive integers n.

By Exercise 3, $F^{-1} : \mathbf{R} \to \mathbf{R}$ exists. Moreover, $\pi F = f\pi$ implies $f^{-1}\pi = \pi F^{-1}$, so that F^{-1} is the lift of f^{-1}. Let $n > 0$. Since F^{-n} is the nth iterate of F^{-1}, F^{-n} is a lift of f^{-n} by the argument above. Hence F^n is a lift of f^n for all integers n.