Exercise 23.4.1(*)

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$$\cfrac{\cfrac{X_1 \;\vdash\; double : \forall X_2.\; (X_2 \to X_2) \to X_2 \to X_2}{X_1 \;\vdash\; double\; [X_1 \to X_1] : T_2 \to T_1}\;\text{T-TAPP} \qquad \cfrac{X_1 \;\vdash\; double : \forall X_3.\; (X_3 \to X_3) \to X_3 \to X_3}{X_1 \;\vdash\; double\; [X_1] : T_2}\;\text{T-TAPP}}{\cfrac{X_1 \;\vdash\; double\; [X_1 \to X_1]\; (double\; [X_1]) : T_1}{\vdash\; \lambda X_1.\; double\; [X_1 \to X_1]\; (double\; [X_1]) : T}\;\text{T-TABS}}\;\text{T-APP}$$

$$\cfrac{\cfrac{\cfrac{X_1 \;\vdash\; double : \forall X_2.\; (X_2 \to X_2) \to X_2 \to X_2}{X_1 \;\vdash\; double\; [X_1 \to X_1] : [X_2 \mapsto X_1 \to X_1]((X_2 \to X_2) \to X_2 \to X_2)}\;\text{T-TAPP}}{X_1 \;\vdash\; double\; [X_1 \to X_1] : ((X_1 \to X_1) \to X_1 \to X_1) \to ((X_1 \to X_1) \to X_1 \to X_1)}\;\text{substitution} \qquad \cfrac{\cfrac{X_1 \;\vdash\; double : \forall X_3.\; (X_3 \to X_3) \to X_3 \to X_3}{X_1 \;\vdash\; double\; [X_1] : [X_3 \to X_1]((X_3 \to X_3) \to X_3 \to X_3)}\;\text{T-TAPP}}{X_1 \;\vdash\; double\; [X_1] : (X_1 \to X_1) \to X_1 \to X_1}\;\text{substitution}}{\cfrac{X_1 \;\vdash\; double\; [X_1 \to X_1]\; (double\; [X_1]) : (X_1 \to X_1) \to X_1 \to X_1}{\vdash\; \lambda X_1.\; double\; [X_1 \to X_1]\; (double\; [X_1]) : \forall X_1.\; (X_1 \to X_1) \to X_1 \to X_1}\;\text{T-TABS}}\;\text{T-APP}$$