MTH 230 HW 1

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August 29, 2024

Excercise 1. 1. Express each statement using P, Q and logical connectives.
(a) P whenever Q. $Q => P$
(b) P is necessary for Q $P => Q$
(c) P is sufficient for Q. $P => Q$
(d) P only if Q. $Q => P$
(e) P is necessary and sufficient for Q $P => Q$

Excercise 2. Prove Pierce's Law:
For any proposition P, Q, the proposition$((P- > Q)- > P)- > P$ is a tautology.

Proof.

P	Q	$P => Q$	$(P => Q) => P$	$((P => Q) => P) => P$
T	T	T	T	T
T	F	F	T	T
F	T	T	F	T
F	F	T	F	T

□

Excercise 3. Prove that $((P => Q) \wedge (Q => R) \wedge P) => R$ is a tautology

Proof.

P	Q	R	$P => Q$	$Q => R$	$(P => Q) \wedge ((Q => R)$	$(P => Q) \wedge (Q => R) \wedge P)$

□