logic pset3

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You may use any of the rules of inference, including reductio ad absurdum, to prove the following sequents.

1.
$$\neg (P \to Q) \vdash Q \to R$$

$$2. \ P \to Q \ \vdash \ \neg P \lor Q$$

3.
$$P \to (R \lor Q) \vdash (P \to R) \lor (P \to Q)$$

4.
$$P \to (Q \lor R) \vdash (P \to Q) \lor R$$