This miniproject asks you to justify some standard rules of inference that will later help you in proving more complicated and specific propositions.

Give formal two-column proofs of each of the following.

(a)

$$\frac{\forall x \left(P(x) \lor Q(x) \right)}{\forall x \left((\neg P(x) \land Q(x)) \to R(x) \right)}$$
$$\frac{\forall x \left((\neg R(x) \land P(x)) \to P(x) \right)}{\forall x \left(\neg R(x) \to P(x) \right)}$$

 $\begin{array}{c} \forall x \left(P(x) \lor Q(x) \right) \\ \forall x \left(\neg Q(x) \lor S(x) \right) \\ \forall x \left(R(x) \to \neg S(x) \right) \\ \exists x \left(\neg P(x) \right) \\ \exists x \left(\neg R(x) \right) \end{array}$