Quiz 1. *True/False*: The expression $P \to Q$ is logically equivalent to $\neg P \vee Q$.

Solution. The statement is true. One method of seeing is this is to compute the truth table for $P \to Q$ and $\neg P \vee Q$ and see that the outputs of $P \to Q$ and $\neg P \vee Q$ match, no matter the inputs for P, Q.

P	Q	$P \to Q$	$\neg P$	$\neg P \vee Q$
T	T	**T**	F	**T**
T	F	**F**	F	**F**
F	T	**T**	T	**T**
F	F	**T**	T	**T**

As we can see, the third and fourth columns corresponding to $P \to Q$ and $\neg P \vee Q$, respectively, are the same, $P \to Q \equiv \neg P \vee Q$. Alternatively, $P \to Q$ will be logically equivalent to $\neg P \vee Q$ if they are always simultaneously true. We know for $P \to Q$ to be true, either P must be false or P, Q must both be true. Observe that if P is false, then $\neg P$ is true so that $\neg P \vee Q$ is true. If P, Q are true, then $\neg P \vee Q$ is true. Loosely, $P \to Q$ is true if either P does not occur or if Q occurs. But this is precisely $\neg P \vee Q$. In any case, it is true that $P \to Q \equiv \neg P \vee Q$.