**Problem 16 (4 points):**
A graph $G$ is called 3-colorable if 3 colors suffice to color its nodes so that no two adjacent nodes have the same color. Consider the problem

$$3\text{COL} = \{ \langle G \rangle \mid G \text{ is 3-colorable} \}$$

Show that $3\text{COL} \in \text{IP}$. That is, design an interactive proof for $3\text{COL}$ and show that it satisfies the conditions of IP.

**Problem 17 (3 points):**
Prove that $\text{NP}$ is equal to the set of all languages $L$ for which there exists a polynomial time checkable relation $R_L$ such that

$$L = \{ x \mid \exists y \ (x, y) \in R_L \}$$

and $(x, y) \in R_L$ only if $|y| \leq \text{poly}(|x|)$. Hint: consider the SAT problem.

**Problem 18 (3 points):**
Look at the proofs in the lecture notes that $\#\text{SAT} \in \text{IP}$ and $\text{PSPACE} \subseteq \text{IP}$ and use the information in these proofs to design an interactive proof for $\text{QSAT}$. (A proof of correctness is not required.)