Name: _____

Pid: _____

1. In this exercise $T_1(x, y)$ is a predicate "x is taller than y". Write each proposition in words.

   (a) (10 points) $\exists x \exists y\ T_1(x, y)$

   (b) (10 points) $\forall x \exists y\ T_1(x, y)$

2. Determine the truth value of each statement

    (a) (10 points) $\forall x \exists y \ x^2 + y^2 = 9$

    (b) (10 points) $\forall x \exists y \ x^2 + y^2 > 0$

3. (10 points) Show that $\left.\begin{array}{c}(p \to q) \land (r \to s) \\ p \lor r\end{array}\right\} \implies q \lor s.$

4. (10 points) Let us consider four-lines geometry, it is a theory with undefined terms: point, line, is on, and axioms:

   1. there exist exactly four lines,
   2. any two distinct lines have exactly one point of on both of them, and
   3. each point is on exactly two lines.

Show that every line has exactly three points on it.