Math 210
Predicate Logic

In propositional logic, variables correspond to statements and each statement could take on precisely two possible truth values: T or F. In predicate logic, we think of variables as the subject of a statement. The **predicate** refers to a property that the subject can have.

Examples:

Variable(s):	x: students in this class	x, y are real numbers
Predicate:	was on time to class today.	greater than
Symbolic form:	$P(x)$: person x was on time to class today.	$Q(x,y)$: $x > y$.
Specific instance(s):	$P(Rebecca)$	$Q(1,3)$, $Q(2,1)$, $Q(2,2)$

Notes:

- The truth value of a specific instance is determined by whether or not the subject has the property that is assigned to it in the predicate statement (here, being on time to class). What is the truth value of each of the specific instances given above?
- When we introduce a variable, we must specify the **domain** of the variable (the set of all possible values). This is especially important when we begin using predicates and quantifiers together.
- Recall that the universal quantifier is represented by the symbol $\forall$ and the existential quantifier is represented by the symbol $\exists$.
- The truth set for a predicate statement is the set of all domain elements that make the statement true.

Exercises:

1. Find the truth set for the statement: $Q(x, 2)$

2. Translate each of the following symbolic statements into plain English. Then determine their truth value.

   (a) $\forall x P(x)$

   (b) $\exists x P(x)$

   (c) $\forall x \exists y Q(x, y)$

   (d) $\exists x \forall x Q(x, y)$

3. Find the negation of one of the statements in the previous problem.