Activity – Tautologies, Predicates, Quantifiers

Name: _____
Name: _____
One CM: _____

1) Show that the following conditional statement is a tautology by using a truth table.

- $(p \wedge q) \rightarrow p$

p	**q**	**$p \wedge q$**	**$(p \wedge q) \rightarrow p$**
T	T		
T	F		
F	T		
F	F		

2) Given the following:

- A data type named: Student
- P (x) be the statement "x can speak Spanish"
- Q(x) be the statement "x knows the computer language C++"
- S(x) be the statement "x is a student at your school"

Express each of these sentences (below) in terms of Student, P (x), Q(x), and S(x) using quantifiers and logical connectives. The domain for quantifiers consists Student.

a) There is a student at your school who can speak Spanish but who doesn't know C++.
b) Every student at your school either can speak Spanish or knows C++.

3) Let P(x) be the statement "$x = x^2$." If the domain consists of the integers, what are these truth values?

a) P(0)
b) P(1)
c) P(2)
d) P(−1)
e) $\exists$ x:Integer P(x)
f) $\forall$ x:Integer P(x)

4) Find a counterexample, if possible, to these universally quantified statements

a) $\forall$ x:Integer ($x^2 \geq x$)
b) $\forall$ x:Integer ($x>0 \vee x<0$)

5) Given an array a1[10] declared in C, C++, or Java, write a quantified proposition stating the fact that a1 is sorted in non-decreasing order