Logic Tutorial 1

Formalise the following sentences a-l in prepositional logic. You may use the following prepositional symbols:

t   Tom is tall
r   Tom is rich
h   Tom is happy
b   Tom drinks beer
w   Tom drinks wine
l   Tom is over the limit
d   Tom drives
c   Tom is caught
f   Tom is fined
p   Tom is imprisoned
fa   Tom falls asleep behind the wheel
cr   Tom has a crash

a. Tom is tall.

b. Tom is tall and rich

c. Tom is rich, but not happy.

d. Tom is neither rich, nor happy.

e. It is not the case that Tom is rich and happy.

f. If Tom is rich then he is happy.

g. Tom is happy if he is rich.

h. Tom is happy only if he is rich.

i. Tom is happy if and only if he is rich.

j. Tom is not happy unless he is rich.

k. If Tom is not rich, he is not happy.

l.   Tom will either drink beer or wine, but he will not drink both. If he does drink both he will be over the alcohol limit. If he is over the alcohol limit and he drives then if he is caught he will either be fined or imprisoned, and if he is not caught he will fall asleep behind the wheel and have a crash.

m. Sergeant James knew that at least one of Adam, Bill and Charles was a thief. He investigated all three and he learned the following additional information:

If Adam was a thief then Charles would also be a thief, provided Bill was not one. If Bill was a thief then so would Charles be a thief. If Charles was a thief then it would not be the case that if Bill was a thief then so would Adam be a thief.

Representing the information above in propositional logic using the propositional symbols
A: for Adam is a thief
B: for Bill is a thief
C: for Charles is a thief.
Can you guess who is a thief and who is not? How did you work it out?