2)

a) Smoke $\Rightarrow$ Fire   ~~Satisfiable~~
                                      Neither

S	T	T	F	F
F	T	F	T	F
a	T	F	F	F

b) Fire $\Rightarrow$ Fire   Valid

F	T	T	F	F
b	T	T	F	F

c) $(\neg Smoke \Rightarrow \neg Fire) \Rightarrow (Smoke \Rightarrow Fire)$ ~~Satisfiable~~
   $(Smoke \vee \neg Fire) \Rightarrow (\neg Smoke \vee Fire)$ IE Neither
       $\neg(Smoke \vee \neg Fire) \vee (\neg Smoke \vee Fire)$ IE

S	T	T	F	F
F	T	F	T	F
C	T	F	T	T

d) $\neg Smoke \vee \neg Fire \vee Fire$ Valid

   $\neg Smoke \vee True$

       True

e) Smoke $\vee$ Fire $\vee$ (Smoke $\Rightarrow$ Fire)   Valid
                                          Implication elimination

   Smoke $\vee$ Fire $\vee$ ($\neg$Smoke $\vee$ Fire)

S	T	T	F	F
F	T	F	T	F
e	T	T	T	T

f) $((Smoke \wedge Heat) \Rightarrow Fire) \Rightarrow (Smoke \Rightarrow Fire)$

$(\neg(Smoke \wedge Heat) \vee Fire) \Rightarrow (\neg Smoke \vee Fire)$

$\neg(\neg(Smoke \wedge Heat) \vee Fire) \vee (\neg Smoke \vee Fire)$

S	T	T	T	T	T	F	F	F	F
H	T	T	F	F	T	T	T	F	F
F	T	F	T	F	T	F	T	F	
	F	T	T	T	F	T	T	T	T

~~Satisfiable~~
Neither

g) $(Smoke \Rightarrow Fire) \Rightarrow ((Smoke \wedge Heat) \Rightarrow Fire)$

$(\neg Smoke \vee Fire) \Rightarrow (\neg(Smoke \wedge Heat) \vee Fire)$

$\neg(\neg Smoke \vee Fire) \vee (\neg(Smoke \wedge Heat) \vee Fire)$

S	T	T	T	T	F	F	F	F
H	T	T	F	F	T	T	F	F
F	T	F	T	F	T	F	T	F
	T	T	T	T	T	T	T	T

Valid

h) $((Smoke \wedge Heat) \Rightarrow Fire) \Leftrightarrow ((Smoke \Rightarrow Fire) \vee (Heat \Rightarrow Fire))$

$(\neg(Smoke \wedge Heat) \vee Fire) \Leftrightarrow ((\neg Smoke \vee Fire) \vee (\neg Heat \vee Fire))$

See next page

h) $((\text{Smoke} \wedge \text{Heat}) \Rightarrow \text{Fire}) \Leftrightarrow ((\text{Smoke} \Rightarrow \text{Fire}) \vee (\text{Heat} \Rightarrow \text{Fire}))$

~~$+(\neg\text{Smoke}$~~

$(\neg(\text{Smoke} \wedge \text{Heat}) \vee \text{Fire}) \Leftrightarrow ((\neg\text{Smoke} \vee \text{Fire}) \vee (\neg\text{Heat} \vee \text{Fire}))$

$(\neg(\text{Smoke} \wedge \text{Heat}) \vee \text{Fire}) \Rightarrow ((\neg\text{Smoke} \vee \text{Fire}) \vee (\neg\text{Heat} \vee \text{Fire}))$

$\wedge$

$((\neg\text{Smoke} \vee \text{Fire}) \vee (\neg\text{Heat} \vee \text{Fire})) \Rightarrow (\neg(\text{Smoke} \wedge \text{Heat}) \vee \text{Fire})$

$\neg(\neg(\text{Smoke} \wedge \text{Heat}) \vee \text{Fire}) \vee ((\neg\text{Smoke} \vee \text{Fire}) \vee (\neg\text{Heat} \vee \text{Fire}))$

$\wedge$

$\neg((\neg\text{Smoke} \vee \text{Fire}) \vee (\neg\text{Heat} \vee \text{Fire})) \vee (\neg(\text{Smoke} \wedge \text{Heat}) \vee \text{Fire})$

S	T	T	T	T	F	F	F	F
H	T	T	F	F	T	T	F	F
F	T	F	T	F	T	F	T	F
h	F	F	F	F	F	F	F	F

~~Invalid~~ Unsatisfiable