

p : Rob is goalie
 q : Aaron is forward
 r : Sam is defense
 $p \wedge q \rightarrow r$ $\neg p \vee \neg q \vee r$

p	q	r	$p \wedge q$	$\neg p \vee \neg q \vee r$
T	F	F	F	T
F	T	F	F	T
F	F	F	F	T

Sep 15-10:08 AM

1.2 #49
 p : compound X is boiling
 q : temp $\geq 150^\circ\text{C}$
 $p \rightarrow q$ is true

- $q \rightarrow p$ converse N.
- $\neg q \rightarrow \neg p$ contrapositive Y
- p only if q $p \rightarrow q$ ✓
 p if and only if q
 \rightarrow if q then p \rightarrow if p then q
- $\neg p \rightarrow \neg q$ inverse X
- nesc. cond. for p is q
 q is nesc. for p
 $\neg q \rightarrow \neg p$ contrapositive ✓
- a suff. cond. for p is q
 q is suff. for p
 if q then p
 $q \rightarrow p$ converse X

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2.4 #20
 All dogs are carnivorous
 Aaron is not a dog
 \therefore Aaron is not carnivorous

$P(x)$: x is a dog.
 $Q(x)$: x is carnivorous

Arg:
 $\forall x, P(x) \rightarrow Q(x)$
 $\neg P(a)$ for a particular a
 $\therefore \neg Q(a)$ not valid

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Universal Modus Tollens
 $\forall x, P(x) \rightarrow Q(x)$
 $\neg Q(a)$ for a particular a
 $\therefore \neg P(a)$

Univ. Modus Ponens
 $\forall x, P(x) \rightarrow Q(x)$
 $P(a)$ for a particular a .
 $\therefore Q(a)$

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