

- 1) a) $p = \text{Mary in CS131}$ $q = \text{Kevin in CS131}$
 Mary and Kevin are not both in CS131

$$p \vee q$$

b) $\neg(p \wedge q)$

c) $p \oplus q$

d) $\neg(p \wedge q)$

2) a) $A \vee B \vee C$

b) Anna would know she had the muddy forehead if Bjorn and Cathy didn't, so, $(A \vee B) \wedge (B \vee C) \wedge (C \vee A)$

c) If Anna was clean then either his or Cathy's was dirty, so $(B \vee C)$, and he can see C.

d) Every child will tell that they have a muddy forehead $A \wedge B \wedge C$

e) They would not get home, unless as none of them can tell themselves if their face was muddy or not.

- 3) $q = \text{you'll be smart}$ $p \wedge r = \text{you'll be happy}$ $p = \text{you study comp sci}$

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

$(\neg p \vee q) \wedge (\neg p \vee r)$ first conditional property

$\neg p \vee (q \wedge r)$ reverse distributive law

$p \rightarrow (q \wedge r)$ reverse first conditional property

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