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1. (a) It's either you have the flu, or you will not miss the final.
   (b) If you don't have the flu and you don't miss the final, you pass the course.
   (c) You have the flu and you don't pass the course, or you miss the final and you pass the course.

2. P = Sunny
   Q = Play tennis
   R = Windy

   (a) $P \rightarrow Q$
   (b) $(P \wedge \neg R) \rightarrow Q$
   (c) $R \rightarrow \neg(Q \rightarrow P)$

3.
   (a) Not true that both David and Ellen want Italian
   $\neg(D \wedge E) = \neg D \vee \neg E$
   (b) Ben and Ellen want same cuisine.
   $B = E$
   (c) Ben and Cathy don't want the same cuisine.
   $B \neq C$
   (d) If Cathy wants Italian, then so does Ann
   $C \rightarrow A$
   (e) If David wants Chinese, then so does Ann and Ellen.
   $D \rightarrow (A \wedge E)$

   Assuming David wants Italian, then Ellen wants Chinese because (a). If Ellen wants Chinese, then Ben wants Chinese because (b). If Ben wants Chinese, then Cathy wants Italian because (c).

   David = Italian
   Ann = Italian
   Ellen = Chinese
   Ben = Chinese
   Cathy = Italian

4.

P	Q	¬P	¬Q	¬P ∨ Q	¬Q ∧ (¬P ∨ Q)	¬Q ∧ (¬P ∨ Q) → ¬P
T	T	F	F	T	F	T
T	F	F	T	F	F	T
F	T	T	F	T	F	T
F	F	T	T	T	T	T

Yes, it is a tautology because the outcomes are all true.

5.

P	Q	R	P ∧ Q	Q ∨ R	(P ∧ Q) → (Q ∨ R)
T	T	T	T	T	T
T	T	F	T	T	T
T	F	T	F	T	T
T	F	F	F	F	T
F	T	T	F	T	T
F	T	F	F	T	T
F	F	T	F	T	T
F	F	F	F	F	T

6. (a)

P	Q	R	P → R	Q → R	(P → R) ∨ (Q → R)	P ∧ Q	(P ∧ Q) → R
T	T	T	T	T	T	T	T
T	T	F	F	F	F	T	F
T	F	T	T	T	T	F	T
T	F	F	F	T	T	F	T
F	T	T	T	T	T	F	T
F	T	F	T	F	T	F	T
F	F	T	T	T	T	F	T
F	F	F	T	T	T	F	T

(b) (P → R) ∨ (Q → R)

≡ (¬P ∨ R) ∨ (¬Q ∨ R)

≡ (¬P ∨ ¬Q) ∨ R

≡ ¬ (P ∧ Q) ∨ R

≡ ¬ (¬ (P ∧ Q)) → R

≡ (P ∧ Q) → R

7. (a) P NAND Q

≡ ¬ (¬P ∧ ¬Q)	DeMorgan's Law
≡ ¬P NAND ¬Q	definition of NAND
≡ (¬P ∧ ¬P) NAND (¬Q ∧ ¬Q)	Idempotent Law
≡ ¬ (P ∧ P) NAND ¬ (Q ∧ Q)	DeMorgan's Law
≡ (P NAND P) NAND (Q NAND Q)	definition of NAND

(b) P XOR Q ≡ (¬P AND Q) OR (P AND ¬Q)