Propositions, Logical equivalences, tautologies, and contradictions.

A proposition is a sentence that declares fact. May be true or false.

Which of the following are propositions:

Boston is the capital of massachusetts	Yes T
Miami is the capital of florida	Yes F
$2+3=5$	Yes T
$5+7=10$	Yes T
$x+z=11$	No
Answer this question	No

T: true F: false } either is fine.
1: true 0: false }

Review connectives: $\neg$, $\wedge$, $\vee$, $\rightarrow$, $\oplus$

Write sentences for the following propositions with

p: Swimming in utah lake is allowed

q: Carps have been spotted in the lake

a) $\neg q$

b) $p \wedge q$

c) $p \vee q$

d) $\neg q \rightarrow p$

Truth tables do simple: $p \rightarrow q$

p q	$p \rightarrow q$
0 0	1
0 1	1
1 0	0
1 1	1

Build truth tables for

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

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

Note 2^n n number vars
size of table.

Do example of Bi-implication: Both agree

$\neg p \leftrightarrow q$

Define tautology by example

Build truth table for $p \to q$ again.

Build table for $\neg p \vee q$

Build table for $\neg q \to \neg p$

Build table $(\neg q \to \neg p) \to (\neg p \vee q) \wedge (\neg p \vee q) \to (\neg q \to \neg p)$

p	q	$p \to q$	$\neg p \vee q$	$\neg q \to \neg p$		
0	0	1	1	1	1	1
0	1	1	1	1	1	
1	0	0	0	0	1	
1	1	1	1	1	1	

for propositions (compound or otherwise)

if $p \leftrightarrow q$ is a tautology,

then $p \equiv q$ logically equivalent

$\Downarrow$ Tautology

Show:

$[\neg p \wedge (p \vee q)] \to q$ is a tautology

$p \leftrightarrow q \equiv (p \wedge q) \vee (\neg p \wedge \neg q)$

Show $p \wedge \neg p$ is a contradiction

Show $\neg(p \wedge \neg p)$ is a tautology

Show $\neg(p \wedge q) \equiv \neg p \vee \neg q$ is a tautology Define De Morgans law

Apply DeMorgan to several examples

$\neg((p \vee q) \to (\neg p \wedge q))$