Quiz 1

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7. Give the converse, the contrapositive, and the inverse of the statement "If the gloves fit, then the jury will acquit".
Converse: If the jury will acquit, then the gloves fit.
Contrapositive: If the jury does not acquit, then the gloves do not fit.
Inverse: If the gloves do not fit, then the jury will not acquit.

8. Negate the following sentences. Be sure to justify your work :

i)Taking the final exam is necessary for passing the class.
   p: taking the final exam q: passing the class
   $p \rightarrow q$ Negation: $\neg(p \rightarrow q) = p \wedge \neg q$
   So the answer is, taking the final exam is not necessary for passing the class.

ii) I will go for a walk unless it rains today.
   p: go for a walk q: it rains
   $p \wedge \neg q$ Negation:$\neg(p \wedge \neg q) = \neg p \vee q$
   So the answer is, I will not go for a walk or it rains.

iii)Today is hot but it is not sunny.
   p = it is hot q = it is sunny
   $p \wedge \neg q$ Negation:$\neg(p \wedge \neg q) = \neg p \vee q$
   So the answer is, it is not hot or it is sunny.

iv) The train is not late or my watch is slow.
   p = the train is late q = my watch is slow
   $\neg p \vee q$ Negation: $\neg(\neg p \vee q) = p \wedge \neg q$
   So the answer is, the train is late and my watch is not slow.

v) Whenever you get a speeding ticket, you are driving over 65 miles per hour.
   p = you get a speeding ticket q = you are driving over 65 miles per hour
   $p \rightarrow q$ Negation: $\neg(p \rightarrow q) = p \wedge \neg q$

So the answer is, You get a speeding ticket and you are not driving over 65 mph.

9. Determine whether the following statements are true or false

1) $1 + 1 = 3$ if and only if $3 + 4 = 9$.
   Since both of these conditions are false the statement is false.
2) $1 + 1 = 2$ if $3 + 4 = 9$.
   Since the first condition is true the statement is true.

10. p = kate is happy q = kate is healthy
$(p \vee (p \wedge q))$
$\equiv (p \vee p) \wedge (p \vee q)$ (Distributive)
$\equiv p \wedge (p \vee q)$ (Idempotent)
$\equiv p$ (Absorption)

11. Let P, Q, and R be the propositions
P: Grizzly bears have been seen in the area.
Q : Hiking is safe on the trail.
R : Berries are ripe along the trail.
Translate the following English sentences into compound logical propositions.

a) It is necessary that berries are ripe for the fact that grizzly bears have seen in the area.
   $R \rightarrow Q$
b) If grizzly bears have not been seen in the area, then hiking is safe on the trail.
   $\neg P \rightarrow Q$
c) Hiking is safe if and only if berries are ripe along the trail or grizzly bears have not been seen in the area.
   $Q \iff (R \vee \neg P)$
d) Hiking is not safe on the trail whenever grizzly bears have been seen in the area and berries are ripe along the trail.
   $\neg Q \rightarrow (P \wedge R)$
e) Neither hiking on the trail is safe nor the berries are ripe along the trail.
   $\neg Q \vee \neg R$

12. Show that the following two compound propositions are logically equivalent using truth table method.
$(p \wedge \neg q) \rightarrow r$ and $p \rightarrow (q \vee r)$

p	q	r	$\neg q$	$p \wedge \neg q$	$q \vee r$	$(p \wedge \neg q) \to r$	$p \to (q \vee r)$
T	T	T	F	F	T	T	T
F	T	T	F	F	T	T	T
T	F	T	T	T	T	T	T
T	T	F	F	F	T	T	T
F	F	T	T	F	T	T	T
F	T	F	F	F	T	T	T
T	F	F	T	T	F	F	F
F	F	F	T	F	F	T	T

13. Simplify the following equation

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

$\equiv (p \vee \neg q) \wedge (p \vee q)$ (De Morgans)

$\equiv p \vee (\neg q \wedge q)$ (Reverse Distributive)

$\equiv p \vee F$ (Negation)

$\equiv p$ (Identitiy)