Math 321

$\square \equiv \triangle$

show?

① Show ($\square \leftrightarrow \triangle$) is a tautology
with a table

② "Discussion"
either show $\square, \triangle$ are false in exact same conditions
or show $\square, \triangle$ are true in exact same conditions.

Know?

table #6 (all)

table #7

distrib.

$$p \to q \equiv (\neg p \lor q)$$

$$(p \to q) \equiv (\neg q \to \neg p)$$

$$\neg(p \to q) \equiv p \land \neg q$$

table #8

$$p \Leftrightarrow q \equiv (p \to q) \land (q \to p)$$

$$p \Leftrightarrow q \equiv \neg p \Leftrightarrow \neg q$$

$$(p \Leftrightarrow q) \equiv (p \land q) \lor (\neg p \land \neg q)$$

To Do?

① Show them. → table?
→ discussion?

② $\boxed{\text{Use them}}$

Uses of $\square \equiv \triangle$?

① restate compound propositions.

If it is sunny, then I go for a walk or I ride my bike.

Same as $\square \to \triangle \equiv \neg\square \vee \triangle$

$\boxed{\text{It's not sunny, I go for a walk, or I ride my bike}}$

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ex Negate this

$\neg$(It's not sunny or I walk or I bike)

$\equiv$ $\boxed{\text{It's sunny and I don't walk and I don't bike}}$

1.4 Proposition: declarative statement (T ⊕ F)

→ " an object has a property "

from a set of elements from a universe of discourse.

predicate

ex Mark is in pain.

object

predicate

U.D. could be all people

we can make function by using a variable object

pain(x): "x is in pain" $\boxed{\text{Propositional function}}$

pain: U.D. → {T or F}

all people

1. evaluation: pain(Mark): "Mark is in pain"
   pain(Jane): "Jane is in pain"

$\boxed{\text{binds}}$ the variable object to a specific element

we have two more ways to bind the variable object

i) "all people in my univ. of disc. are in pain"

ii) "some one in my univ. of disc. is in pain"

(ex) stinky(□): "□ loves stinky cheese"
U.D for □ is people in this room.

Bind

1. evaluate: stinky(Mark)

2. "all" "all people love stinky cheese"

$\forall_p$ stinky(p) $\boxed{\text{universal quantification}}$

people $\quad$ food

$\forall q \quad \text{loves}(q, \text{cheese})$

Scope

(3) "Some" : "Someone loves stinky cheese"

there Exists someone

$\boxed{\exists x \ \text{stinky}(x)}$ existential quantification

if U.D. is finite. $p_1, p_2, \ldots, p_n$

$$\forall p \ f(p) \equiv f(p_1) \wedge f(p_2) \wedge \ldots \wedge f(p_n)$$

$$\exists p \ f(p) \equiv f(p_1) \vee f(p_2) \vee \ldots \vee f(p_n)$$

Negation

$$\neg \forall p \ f(p) \equiv \exists p \ \neg f(p)$$

$$\neg \exists p \ f(p) \equiv \forall p \ \neg f(p)$$
