Math 245: 2.2 Conditional Statements

Conditional Statement: **"If p then q"** $p \to q$

Writing IF-THEN as an OR $p \to q \equiv \sim p \vee q$

Negation of IF-THEN $\sim (p \to q) \equiv \sim (\sim p \vee q) \equiv p \wedge \sim q$

The <u>contrapositive</u> of $p \to q$: $\sim q \to \sim p$

The <u>converse</u> of $p \to q$: $q \to p$

The <u>inverse</u> of $p \to q$: $\sim p \to \sim q$

Of these 4 statements, which are *logically equivalent*?

The conditional and its contrapositive: $p \to q \equiv \sim q \to \sim p$

The converse and the inverse of $p \to q$: $q \to p \equiv \sim p \to \sim q$

"Only If" Statement: **"p only if q"** means "if not q, then not p"

$$\sim q \to \sim p \quad \equiv \quad p \to q$$

"if not q, then not p" "if p, then q"

Biconditional Statement: **"p if and only if q"** $p \leftrightarrow q$

also "p iff q"

$$p \leftrightarrow q \equiv (p \to q) \wedge (q \to p)$$

Necessary and Sufficient Conditions:

"r is a <u>sufficient condition</u> for s" means "if r then s" $r \to s$

"r is a <u>necessary condition</u> for s" means "if not r then not s" $\sim r \to \sim s \equiv s \to r$

"r is <u>a necessary and sufficient condition</u> for s" means $r \leftrightarrow s$

"Unless" Statement:

"r unless s" means "if not s, then r" $\sim s \to r$