

You MUST use good notation **Math 102**
and show appropriate work. (Section 3.3)

Name Key

3.3 Conditional and Biconditional

1. Complete the following truth tables. Circle your final answers.

a)

p	q	$p \rightarrow q$	$\sim q \rightarrow \sim p$	$\sim p \vee q$	$p \wedge (\sim q)$	$\sim (p \leftrightarrow q)$
T	T	T	F	F	T	F
T	F	F	T	F	T	T
F	T	T	F	T	F	T
F	F	T	T	T	F	F

2 b)

p	q	r	$(p \rightarrow q) \rightarrow r$	$(p \rightarrow q) \leftrightarrow \sim r$
T	T	T	T	T
T	T	F	F	F
T	F	T	T	T
T	F	F	T	T
F	T	T	T	F
F	T	F	T	F
F	F	T	T	F
F	F	F	T	T

2. Use truth tables to argue that $p \rightarrow (q \wedge r)$ is logically equivalent to $(p \rightarrow q) \wedge (p \rightarrow r)$.

2

p	q	r	$p \rightarrow (q \wedge r)$	$(p \rightarrow q) \wedge (p \rightarrow r)$
T	T	T	T	T
T	T	F	F	F
T	F	T	F	F
T	F	F	F	F
F	T	T	T	T
F	T	F	T	T
F	F	T	T	T
F	F	F	T	T

equivalent

3. In each write out the i) contrapositive, ii) converse and iii) inverse of the given conditional statement.

a) If you score 100% on each exam, then you will earn an A grade in the course.

i) If you do not earn an A in the course, then you did not score 100% on each exam.

ii) If you earn an A in the course, then you scored 100% on each exam

iii) If you do not score 100% on each exam, then will not earn an A in this course.

b) If the horse does not run fast, then the horse will lose the race.

i) If the horse does not lose the race, then the horse ran fast.

ii) If the horse loses the race, then the horse did not run fast

iii) If the horse does run fast, then the horse will not lose the race.

4. Assume m represents "living in Minnesota", c represents living in Clay County (of Minnesota)" and h represents "living in Moorhead (of Clay County).

a) Symbolize each of the following:

i) One is living in Minnesota if one is living in Moorhead.

$$h \rightarrow m$$

ii) One can live in Clay County only if one lives in Minnesota.

$$c \rightarrow m$$

iii) Living in Minnesota is not sufficient for living in Moorhead.

$$\sim (m \rightarrow h)$$

b) In each fill in the slot with the appropriate word - either "necessary" or "sufficient" and then symbolize the compound statement.

i) Living in Moorhead is sufficient for living in Minnesota.

$$h \rightarrow m$$

ii) Living in Minnesota is necessary for living in Clay County.

$$c \rightarrow m$$