Nelson
Wang
①

HW 3 -1

| Section 2.2 |

1) a)

Converse: $(q \wedge r) \to p$

Contrapositive $\neg(q \wedge r) \to \neg p$

b) Converse   If $(x^2+y^2) \geq 1$ then $x+y=1$

   Contrapositive If $(x^2+y^2) < 1$ then $x+y \neq 1$

c) Converse   If $(3+3=8)$ then $(2+2=4)$

   If $(3+3 \neq 8)$ then $(2+2 \neq 4)$

③ a) $q \to p$ b) $\neg p \to \neg q$ c) $\neg p \vee q$ && $\neg q \to \neg p$

⑨

P	q	r	$\neg q$	P∨q	$[(p\vee q) \wedge r]$	$(p \wedge \neg q)$	$[(p\vee q)\wedge r] \neq (p \wedge \neg q)$
0	0	1	1	0	0	0	1
0	0	1	1	0	0	0	1
0	1	0	0	1	0	0	1
0	1	0	0	1	1	0	0
1	0	1	1	1	0	1	1
1	0	1	1	1	1	1	1
1	1	0	0	1	0	0	1
1	1	0	0	1	1	0	0

11) a)

P	q	r	$(p\vee q)$	$\neg(p\vee q)$	$\neg(p\vee q) \to r$
0	0	0	0	1	0
0	0	1	0	1	1
0	1	0	1	0	1
0	1	1	1	0	1
1	0	0	1	0	1
1	0	1	1	0	1
1	1	0	1	0	1
1	1	1	1	0	1

Section 2.1

1)
a) $P \wedge Q$ b) $P \rightarrow r$ c) $\neg P \rightarrow (\neg Q \wedge r)$ d) $Q \leftrightarrow \neg P$ e) $\neg r \rightarrow q$

2) a) there is No rain nor sun shining, but there are clouds
   d) There is no raining only if the sun shines and clouds are on the sky

6) B) If I am smart, then I am Rich
   c) if $x = 0$ or $x = 1$, then $x^2 = x$

7) B) If I am not rich, Then I am not smart
   c) If $x \neq 0$ or $x \neq 1$, then $x^2 \neq x$

9) a) Does Not Hold   b) No counterexamples, thus it Holds

11) a) Not Hold, $x = -1$ b) Does Not Hold for $x = -2$
    $(-1+1)^2 \geq -1^2$? x $(-2+1)^2 \geq -2^2$ No

    c) No   b) $2^3 + 3^3 = 35 \in$ Prime

12) a) $2^n - 1$ Not hold for $n = 3$
    $2^4 = 16 \rightarrow 16 - 1 = 15 \notin$ Prime

    Not Hold $n = 4$

    c) $2^7 + 7 = 135 \notin$ Prime

    Not Hold for $n = 7$

14) a) true, commutative law
    b) False $A = \{1, 2, 3\}$ $B = \{3, 4, 5\}$
              $A \setminus B = \{1, 2\}$ to $(A \setminus B) \cup B = \{1, 2, 3, 4, 5\}$

    c) false, $A = ''$ $B = ''$ $A \cup B = \{1, 2, 3, 4, 5\}$
               $(A \cup B) \setminus A = \{4, 5\}$

    b) true, commutative law

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13)

a)

P	Q	$\neg(P \leftrightarrow Q)$
0	0	0
0	1	1
1	0	1
1	1	0

b)

P	P	$P \oplus P$
0	0	0
1	1	1

c)

P	Q	R	$(P \oplus Q) \oplus r$
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

d)

P	P	$(P \oplus P) \oplus P$
0	0	0
1	1	1

16) A) $(P \lor Q) \lor (Q \lor r) \lor (r \lor P) \lor (P \lor Q \lor r)$

18) C) commutative law

19) A) ? the what?

20) b)

P	Q		$P \lor Q$	$(P \lor Q) \land \neg P$		Prove	$P \lor Q$
0	0		0	0 ✓			$\neg P$
0	1		1	1 ✓ → proves			∴ Q
1	0		0	0 ✓			
1	1		0	0 ✓			

22 a) false,

$$p \quad Q \quad (Q \to P) \quad P \land Q$$
$$0 \quad 1 \quad 0 \quad 0$$

23) Logician is a bad father
also P = "finish dinner" Q = "watch tv)
    $\neg P \to \neg Q$ // still holds

24 a) If water the concrete grows
    b) If you don't water then concrete don't grow
    c) concretes grows if water M
    d) Ⓑ