1.1 6, 10
1.2 2, 4, 10, 12
1.3 2, 12, 16

Brandon Anderson
Section 1.1 – 1.3

1.1

6. a) The election is not decided
b) The election is decided or the votes have been counted.
c) The election is not decided and the vote votes have been counted.
d) If the votes have been counted then the election is decided.
e) If the votes have not been counted then the election is not decided.
f) If the election is not decided then the votes have not been counted.
g) If and only if the election is decided then the votes have been counted
h) The votes have not been counted or, the election is not decided and the votes are counted.

10. a) $r \wedge \neg q$ b) $p \wedge q \wedge r$ c) $r \leftrightarrow p$

d) $p \wedge \neg q \wedge r$ e) $(p \wedge q) \rightarrow r$

f) $r \leftrightarrow (q \vee p)$

1.2

2)

p	$\neg p$	$\neg(\neg p)$
T	F	T
F	T	F

4)

p	q	r	(p ∨ q) ∨ r	p ∨ (q ∨ r)
T	T	T	T	T
T	T	F	T	T
T	F	T	T	T
T	F	F	T	T
F	T	T	T	T
F	T	F	T	T
F	F	T	T	T
F	F	F	F	F

p	q	r	(p ∧ q) ∧ r	p ∧ (q ∧ r)
T	T	T	T	T
T	T	F	F	F
T	F	T	F	F
T	F	F	F	F
F	T	T	F	F
F	T	F	F	F
F	F	T	F	F
F	F	F	F	F

10)

a)

p	q	[p ∨ q]	[¬p ∧ (p ∨ q)]	[¬p ∧ (p ∨ q)] → q
T	T	T	F	T
T	F	T	F	T
F	T	T	T	T
F	F	F	F	T

c)

p	q	p → q	p ∧ (p → q)	[p ∧ (p → q)] → q
T	T	T	T	T
T	F	F	F	T
F	T	T	F	T
F	F	T	F	T

$[(p \to q) \wedge (q \to r)] \to (p \to r)$

10) b)

p	q	r	$p \to q$	$q \to r$	$(p \to q) \wedge (q \to r)$	$p \to r$	$[(p \to q) \wedge (q \to r)] \to (p \to r)$
T	T	T	T	T	T	T	T
T	T	F	T	F	F	F	T
T	F	T	F	T	F	T	T
T	F	F	F	T	F	F	T
F	T	T	T	T	T	T	T
F	T	F	T	F	F	T	T
F	F	T	T	T	T	T	T
F	F	F	T	T	T	T	T

d)

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

12) a) $[\neg p \wedge (p \vee q)] \to q$

$[(\neg p \wedge p) \vee (\neg p \wedge q)] \to q$ Distributive

$[F \vee (\neg p \wedge q)] \to q$ Negation

$(\neg p \wedge q) \to q$ Identity

$(\neg p \to q) \vee (q \to q)$ Def Impl

$(\neg\neg p \vee q) \vee (\neg q \vee q)$ Def Impl

$(p \vee q) \vee T$ Double Neg / Neg Domination

$\boxed{T}$

b) $[(p \to q) \wedge (q \to r)] \to (p \to r)$

$[(\neg p \vee q) \wedge (\neg q \vee r)] \to (\neg p \vee r)$ Def Impl

$\neg[(\neg p \vee q) \wedge (\neg q \vee r)] \vee (\neg p \vee r)$ Def Impl

$[\neg(\neg p \vee q) \vee \neg(\neg q \vee r)] \vee (\neg p \vee r)$ De Morg

$(p \wedge \neg q) \vee (q \wedge \neg r) \vee (\neg p \vee r)$ De Morg / Double Neg

c) $[p \wedge (p \to q)] \to q$

$[p \wedge (\neg p \vee q)] \to q$ — Def Impl

$[(p \wedge \neg p) \vee (p \wedge q)] \to q$ — Distributive

$[F \vee (p \wedge q)] \to q$ — Negation

$(p \wedge q) \to q$ — Identity

$(p \to q) \vee (q \to q)$ — Def Impl

$(\neg p \vee q) \vee (\neg q \vee q)$ — Def Impl

$\neg p \vee q \quad \vee \quad T$ — Negation

$\boxed{T}$ — Domination

d) $[(p \vee q) \wedge (p \to r) \wedge (q \to r)] \to r$

$[(p \vee q) \wedge (p \wedge q) \to r] \to r$ — Def. Imp

$[(p \vee q) \wedge \neg(p \wedge q) \vee r] \to r$ — Def. Imp

$[(p \vee q) \wedge (\neg p \vee \neg q) \vee r] \to r$ — De Morg

$F \vee r \to r$ — Negation

$r \to r$ — Identity

$\neg r \vee r$ — Def. Imp

T — Negation

1.3

2) a) True b) False c) False d) True

12) a) True b) True c) False d) True
e) False f) True g) False

16) a) True b) False c) True d) False