3. Formal Proofs

(a)

1.	$(P \wedge \neg q) \vee (\neg P \wedge q)$	given
2.	$r \rightarrow \neg s$	given
3.	$(S \wedge P) \rightarrow r$	given
4.	$S \rightarrow \neg r$	Contrapositive: 2
5.	$\neg r \rightarrow \neg(S \wedge P)$	Contrapositive: 3
6.	$\neg r \rightarrow (\neg S \vee \neg P)$	de Morgan's Law: 5
7.1	S	Assumption
7.2	$\neg r$	MP: 4, 7.1
7.3	$\neg S \vee \neg P$	MP: 6, 7.2
7.4	$\neg(\neg S)$	double negation: 7.1
7.5	$\neg P$	ElimV: 7.3, 7.4
7.6	$\neg P \vee q$	IntroV: 7.5
7.7	$\neg(P \wedge \neg q)$	de Morgan Law: 7.6
7.8	$\neg P \wedge q$	ElimV: 1, 7.7
7.9	q	ElimA: 7.8
7.	$S \rightarrow q$	Double Proof Rule

(b)

1.1	$(P \rightarrow q) \wedge (r \rightarrow \neg q)$	Assumption
1.2	$P \rightarrow q$	ElimA: 1.1
1.3	$r \rightarrow \neg q$	ElimA: 1.1
1.4	$q \rightarrow \neg r$	Contrapositive: 1.3
1.5.1	P	Assumption
1.5.2	q	MP: 1.2, 1.5.1
1.5.3	$\neg r$	MP: 1.4 1.5.2
1.5	$P \rightarrow \neg r$	Double Proof rule
1.6	$r \rightarrow \neg P$	Contrapositive: 1.5

1. $(P \rightarrow q) \wedge (r \rightarrow \neg q) \rightarrow (r \rightarrow \neg P)$ Double proof Rule