Math 108, Fall 2026

HW 1 solutions.

1.1 3(h)

P	Q	$\sim P \wedge \sim Q$
F	F	T
F	T	F
T	F	F
T	T	F

4(d) $\sim S$ is T, so the disjunction is T.

6(h) Not equivalent. If P is T, Q and R are F, then $(P \wedge Q) \vee R$ is F, while $P \vee (Q \wedge R)$ is T.

9(a) Neither. If both P and Q are T, then the value is T, while if P is T and Q is F, the value is F.

10(b) Tautology.

1.2 3(e) Q is False. 5(d) True, as $F < 2$ is False.

6(b). True, as both sides are True.

7(a). This is equivalent to $P \Rightarrow Q$, so it is F iff P is T and Q is F.

12(f). If both P and Q are T, or both are F, both statements are T. If P is F and Q is T (or vice versa), both statements are F.

16(b). Tautology. If P is T, $P \wedge (P \vee Q)$ is T regardless of Q, and if P is F, $P \wedge (P \vee Q)$ is F regardless of Q.

1.3 6(c) In T (as $(x > 8)$ is always True), in $\forall$ (as (x odd) is always False), in $\forall$ (as $(x > 8)$ is always True), but not in W (take $x = 3$).

8(c) False (the only solution $x = -1$ is not in $\mathbb{N}$)

10(c) False. The negation $(\forall x)(\forall y)(x^2 + y^2 \neq -1)$ is True as $x^2 + y^2 \geq 0$.

10(e) True. Take $x = 0$. (So even $(\exists x)(\forall y)(\forall z)(xy = xy)$ is True!)