# Chapter 9 handout

**1.**

| P Q | P → Q | P & ¬ Q |
|-----|-------|---------|
| T T | T T T | T F F T |
| T F | T F F | T T T F |
| F T | F T T | F F F T |
| F F | F T F | F F T F |

**2.**

| P Q | P v Q | ¬ P → Q |
|-----|-------|---------|
| T T | T T T | F T T T |
| T F | T T F | F T T F |
| F T | F T T | T F T T |
| F F | F F F | T F F F |

**3.**

| S T | ¬ S & T | T ↔ ( S → ¬ S ) |
|-----|---------|-----------------|
| T T | F T F T | T F   T F F T |
| T F | F T F F | F T   T F F T |
| F T | T F T T | T T   F T T F |
| F F | T F F F | F F   F T T F |

**4.**

| R S | R & ¬ S | S ↔ ( R v ¬ R ) |
|-----|---------|-----------------|
| T T | T F F T | T T   T T F T |
| T F | T T T F | F F   T T F T |
| F T | F F F T | T T   F T T F |
| F F | F F T F | F F   F T T F |

**5.**

| P Q | ¬ ( P v Q ) | ¬ P & ¬ Q |
|-----|-------------|-----------|
| T T | F T T T | F T F F T |
| T F | F T T F | F T F T F |
| F T | F F T T | T F F F T |
| F F | T F F F | T F T T F |

**6.**

| Q | P ↔ Q | ( P & Q ) v ( P & ~ Q ) |
|---|-------|-------------------------|
| T | T T T | T T T  T  T F F T |
| F | T F F | T F F  T  T T T F |
| T | F F T | F F T  F  F F F T |
| F | F T F | F F F  F  F F T F |

**7.**

| P Q | ~ ( P ↔ Q ) | ~ P ↔ Q |
|-----|-------------|---------|
| T T | F T T T | F T F T |
| T F | T T F F | F T T F |
| F T | T F F T | T F T T |
| F F | F F T F | T F F F |

**8.**

| P Q | P v ~ Q | ~ ( Q → P ) |
|-----|---------|-------------|
| T T | T T F T | F T T T |
| T F | T T T F | F F T T |
| F T | F F F T | T T F F |
| F F | F T T F | F F T F |

**9.**

| P Q | ~ ( P v Q ) | ~ P v ~ Q |
|-----|-------------|-----------|
| T T | F T T T | F T F F T |
| T F | F T T F | F T T T F |
| F T | F F T T | T F T F T |
| F F | T F F F | T F T T F |