**#10.**

1. R → P
2. Q ↔ (R ∨ ~P)
3. ~ (Q ∧ R)

**#11.** ~(p ∨ ~q) ∨ (~p ∧ ~q)

* (~p ∨ q) ∨ (~p ∧ ~q) Double Negative Law
* (~p ∨ q) ∨ ~(p ∨ q) De Morgan’s Laws
* (~p ∨ q) ∨ ~q Associative
* ~p ∨ (q ∨ ~q) Negation Law
* ~p ∨ T Domination Law

**#12.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| p | q | r | p → q | (p → q) ∨ r |
| T | T | T | T | T |
| T | T | F | T | T |
| T | F | T | F | T |
| T | F | F | F | F |
| F | T | T | T | T |
| F | T | F | T | T |
| F | F | T | T | T |
| F | F | F | T | T |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| p | q | r | p ∧ ~q | ~((p ∧ ~q) ∧ ~r) |
| T | T | T | F | T |
| T | T | F | F | T |
| T | F | T | T | T |
| T | F | F | T | F |
| F | T | T | T | T |
| F | T | F | T | T |
| F | F | T | T | T |
| F | F | F | T | T |

Yes they are equivalent