**9**.

~(P ≡ ~Q)

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

**10.**

(P ⊃ Q) v ~R

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

**11.**

**Invalid**

~P ⊃ Q

Q

------------------

∴ ~P

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| P | Q | ~P ⊃ Q | Q | ~P |  |
| T | T | T | T | F | Invalid |
| T | F | F | F | F |  |
| F | T | T | T | T |  |
| F | F | T | F | T |  |

**12.**

**Valid**

P & R

R ⊃ ~(Q & P)

-----------------------

∴ ~Q

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| P | Q | R | P & R | R ⊃ ~(Q & P) | ~Q |
| T | T | T | T | F | F |
| T | T | F | F | T | F |
| T | F | T | T | T | T |
| T | F | F | F | T | T |
| F | T | T | F | T | F |
| F | T | F | F | T | F |
| F | F | T | F | T | T |
| F | F | F | F | T | T |