(ca) X (b(x) → 3 A (b) V (x.1.8) 3. (a) D=R PIX)= "X=1" Q(x)= "X=1", formula is 7 (bix) V A A (bin) V JE(x.A) → r(A·x)) PIX)= "x=1" (L (x)= "x+1", = x (PO) +> (ROX)) is false. 2. (a) DI= {1} + + , x, y, z & D, x = y - Z = 1 =7 satisfiable $\forall x(\forall y (x \neq y) \rightarrow \forall z ((z=x) V(z=y))$ (b) 3 x (TVP(X) > F) = Ax(A(t → I)) = Ax (In1) =1 = = x (ffn + p(x)) u F) = 7, unsatisfiable. (b). 7A=7 (4x (4y((x+y) → Y=1(Z=x)v (Z=y)))) = 3x(34((x+4)) 3= 7(2=x)) (x+4))) P2= {1, 2,3}. When xel, y.2, 8=3. 7 A= 3x (3y (T) = T , A= F. Interpretation: 4. (a) P(x) = "x=1" Q(x) = "x=0" X & Domin: {0.1}. 3x (P(x) V (R (x)) = T for x & D (x=0, x=1). Ax (x) A Ax (x (x) = 1 when $\forall x P(x) |_{X>0} \cup \forall x Q(x) |_{X=1} = F \cup F = F$. =) Not by: cally equivalent 167 Interpretations P(x)= " x=1" Q(x) = " x=0" x & Ponan : {0,1}. 3x(P(x) ∧ Q(x)) = F for x ∈ {0,1}. (3x P(x) |x=1) \(\lambda(\frac{1}{2}x \mathbb{Q}(\frac{1}{2})\rangle \tag{x=0}\) is true. => we logically equivalent 5.03x(p(x)) xEV ((x)) > 3x(p(x)) V3x(L(x) supp-se left is T in interpreturen I. =) exist x Plx) is T or Q(x) is T. =7 exist x, pur is T or exist x. Q(x) is T. -7 BXP(X) V BX (R(X) is Tin I. Q(x)D U RU) X € ← (x)DX EV (x)) Suppose left is T in incorpretation I. =) exist x. p(x) is T or exist x, Q(x) is 7.

= exist , lix, very is T.

-) . By (PUXUQU)) is T in I.

INM OB - IX (P(X) V(Q(X)) = BX P(N) U IX Q(X).

(1) YX(P(x) V - 34(Q(4) 17Q(4)) = Vx (P(x) V 77) = T. l-g-colly valid. 6. Yx(pix1 -> Q(x)) => Yxpix) -> YxQ(x). suppose left is T for all interpretation I. -> P(x) -> C(ix) is I for all x & D. on TPIX) UQW is T for all XED. => 7 p(x) is | or Q(x) is T. => Uxipix) UQ wis T for all I. => Vxp(x) -> Vx ((x) is f for all I. 7. 3× P(x) 1 /2 (x) => 3×(P(x)1 (x)) suppose left is T for interpresent on I.

=) . $3 \times p(x)$ is T, $\forall x Q(x)$ is T in I. => . exist x that plus is 1, Q cry 157 J I in I is ((x) D N (x) q) X E (=

formula is F