1.(1) $\neg(\exists x)(\exists y)(P(x)\wedge P(y)\wedge Q(x)\wedge Q(y)\wedge R(x,y))$

$=(\forall x)\neg(\exists y)(P(x)\wedge P(y)\wedge Q(x)\wedge Q(y)\wedge R(x,y))$

$=(\forall x)(\forall y)\neg((P(x)\wedge P(y)\wedge Q(x)\wedge Q(y))\wedge R(x,y))$

$=(\forall x)(\forall y)(\neg(P(x)\wedge P(y)\wedge Q(x)\wedge Q(y))\vee\neg R(x,y))$

$=(\forall x)(\forall y)((P(x)\wedge P(y)\wedge Q(x)\wedge Q(y))\rightarrow\neg R(x,y))$

(4) $(\forall y)(\exists x)((P(x)\rightarrow q)\vee S(y))$

$=(\forall y)((\exists x)(P(x)\rightarrow q)\vee S(y))$

$=(\exists x)(P(x)\rightarrow q)\vee(\forall y)S(y)$

$=((\forall x)P(x)\rightarrow q)\vee(\forall y)S(y)$

(7) $(\exists x)P(x)\rightarrow(\forall x)Q(x)$

$=\neg(\exists x)P(x)\vee(\forall x)Q(x)$

$=(\forall x)\neg P(x)\vee(\forall x)Q(x)$

$\Rightarrow(\forall x)(\neg P(x)\vee Q(x))$

$=(\forall x)(P(x)\rightarrow Q(x))$

2.(1) 在{1,2}域上分析，当 $P(1)=P(2)=Q(1)=F$，$Q(2)=T$ 时

$(\exists x)(P(x)\Leftrightarrow Q(x))\rightarrow((\exists x)P(x)\Leftrightarrow(\exists x)Q(x))$.

$=T\rightarrow(F\Leftrightarrow T)=T\rightarrow F=F$

所以原公式不是普遍有效的

(3) $((\exists x)P(x)\rightarrow(\forall x)Q(x))\rightarrow(\forall x)(P(x)\rightarrow Q(x))$.

$=(\neg(\exists x)P(x)\vee(\forall x)Q(x))\rightarrow(\forall x)(\neg P(x)\vee Q(x))$

$=((\forall x)\neg P(x)\vee(\forall x)Q(x))\rightarrow(\forall x)(\neg P(x)\vee Q(x))$

$=T$

故原公式是普遍有效的.

(5) $((\exists x)P(x)\rightarrow(\exists x)Q(x))\rightarrow(\exists x)(P(x)\rightarrow Q(x))$

$=\neg(\neg(\exists x)P(x)\vee(\exists x)Q(x))\vee(\exists x)(\neg P(x)\vee Q(x))$

$=(\exists x)P(x)\vee\neg(\exists x)Q(x)\vee(\exists x)\neg P(x)\vee(\exists x)Q(x)$

$=T$

故原公式是普遍有效的.