Example

Example 1: let UD be the real number

P(x,y) = x * y =0

What is the truth value of the following:

$\forall$ x $\forall$y P(x,y) : fasle

$\forall$ x $\exists$y P(x,y): true

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$\exists$x $\exists$y P(x,y): true

Example 1: let UD be the real number

P(x,y) = x / y =1

What is the truth value of the following:

$\forall$ x $\forall$y P(x,y) : false

$\forall$ x $\exists$y P(x,y): true

$\exists$x $\forall$y P(x,y): false

$\exists$x $\exists$y P(x,y): true

For example, in $\forall$ x $\exists$ y(x + y = 0), you would loop through ALL the elements in the domain for x, searching for AT LEAST one element for y that satisfies the statement.

In $\exists$ x $\forall$ yQ(x,y), you would loop through the domain, testing every x until you find ONE x that satisfies the statement for ALL y

English	First-Order
At least one x is P	$\exists x P(x)$
All x are P	$\forall x P(x)$
Some x are P	$\exists x P(x)$
Not all x are P	$\exists x \neg P(x)$
No x are P	$\forall x \neg P(x)$

$$\neg\left(\forall x P(x)\right) \equiv \exists x(\neg P(x))$$

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$$\forall x \forall y Q(x, y) \equiv \forall y \forall x Q(x, y)$$

$$\exists x \exists y Q(x, y) \equiv \exists y \exists x Q(x, y)$$