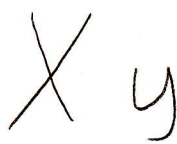


When quantifiers are same they commute

2. Assume the universe is all the people in this class and let $T(x, y)$ mean x is taller than y . Match each formula in the first list with a translation in the second list.

- | | |
|---|---|
| \forall (a) $\forall x \forall y T(x, y)$ | (i) There is a person in the class that is shorter than everyone in the class. \exists |
| \forall (b) $\forall y \forall x T(x, y)$ | (ii) There is a person in the class that is taller than everyone in the class. \exists |
| \forall (c) $\exists x \exists y T(x, y)$ | (iii) Given anyone in the class, we can find someone in the class who is shorter. $\forall x \exists y$ |
| \forall (d) $\exists y \exists x T(x, y)$ | (iv) Given anyone in the class, we can find someone in the class who is taller. $\forall y \exists x$ |
| \forall (e) $\forall x \exists y T(x, y)$ | (v) If x and y are people in the class, then x is taller than y . $\forall x \forall y$ |
| \forall (f) $\forall y \exists x T(x, y)$ | (vi) There are people x and y in the class such that x is taller than y . |
| \exists (g) $\exists x \forall y T(x, y)$ | |
| \exists (h) $\exists y \forall x T(x, y)$ | |

$x > y$
try to find a "leader"



* I'm having trouble going from words to symbols. How can I break down the sentences?

3. Give a useful denial of the mean value theorem which states

If $f(x)$ is continuous on the interval $[a, b]$ and differentiable on the interval (a, b) then there exists some c in the interval (a, b) such that $f'(c) = \frac{f(b) - f(a)}{b - a}$.

Universe = a to b

$if = universe$
Treat the "if" as a hidden quantifier.

Symbols = $\forall x \exists c$ $f'(c) = \frac{f(b) - f(a)}{b - a}$
 denial = $\neg (\forall x \exists c f'(c) = \frac{f(b) - f(a)}{b - a})$
 $\exists x \forall c f'(c) \neq \frac{f(b) - f(a)}{b - a}$

$\exists f(x) \forall c \neg A(a, b, c)$

We can find any value of x on $[a, b]$ such that any value

IF $f(x)$ is cont. on $[a, b]$ and not diff. then

$f'(c) \neq \frac{f(b) - f(a)}{b - a}$

Another way:

IF A and B then $\exists c C(x)$

$(A \wedge B) \rightarrow (\exists c C(x))$

$\neg (A \wedge B)$
 $(A \wedge B) \wedge \neg (\exists c C(x))$