1. How do you represent "Neko is a cat" in predicate logic?

- **Answer:** You'd use a simple predicate, like `Cat(neko)`.
  - Here, `Cat()` is the **predicate** (representing the property of being a cat), and `neko` is a **constant** (representing the specific entity, Neko).

What's the logical form for "Something is sleeping"?

- **Answer:** `∃x Sleeping(x)`
  - The **existential quantifier** `∃x` means "there exists at least one x," and `Sleeping(x)` means "x is sleeping." So, this reads as "There exists some x such that x is sleeping."

How would you write "All birds can fly"?

- **Answer:** $\forall x\ (Bird(x) \rightarrow CanFly(x))$
  - The **universal quantifier** $\forall x$ means "for all x." The formula reads, "For any entity x, **if** x is a bird, **then** x can fly." We use an **implication** ($\rightarrow$) with the universal quantifier for conditional statements like this.

What's the logical representation of "John did not laugh"?

- **Answer:** `¬Laugh(john)`
    - This is a straightforward negation. `Laugh(john)` means "John laughed," and the **negation** symbol `¬` in front of it means "it is not the case that John laughed."

How do you translate "Some students are smart"?

- **Answer:** $\exists x\ (\mathrm{Student}(x) \land \mathrm{Smart}(x))$
  - This means "There exists some x such that x is a student **and** x is smart." When using the existential quantifier $\exists$ to specify a property of a subset, you almost always use a **conjunction** ($\land$).

What is the logical form for "Every student read a book"?

- **Answer:** $\forall x\ (Student(x) \rightarrow \exists y\ (Book(y) \land Read(x,y)))$
  - This breaks down as: "For every x, if x is a student, then there exists some y such that y is a book, and x read y." This captures the relationship between students and the books they read.

How do you represent "No one likes taxes"?

- **Answer:** $\neg\exists x\ (Person(x) \land Likes(x, taxes))$ or its equivalent $\forall x\ (Person(x) \rightarrow \neg Likes(x, taxes))$
  - The first reads, "It is not the case that there exists a person x who likes taxes." The second reads, "For every person x, it is the case that x does not like taxes." Both are logically equivalent and correct!

What is the logical form for "Everyone loves someone"?

- **Answer:** $\forall x\ (Person(x) \rightarrow \exists y\ (Person(y) \land Loves(x,y)))$
  - This classic sentence shows the interaction of two quantifiers. It states that for every person x, you can find at least one person y whom x loves. The person y can be different for each x.

How do you differentiate "Everyone loves someone" from "Someone is loved by everyone"?

- **Answer:** By swapping the quantifier order.
  - **Everyone loves someone:** $\forall x \ \exists y \ Loves(x,y)$
  - **Someone is loved by everyone:** $\exists y \ \forall x \ Loves(x,y)$
  - In the second sentence, the existential quantifier $\exists y$ comes first. This means there is **one specific person** y who exists, and for all people x, x loves that single person y. The order of quantifiers is critical for meaning!