We've talked about pushouts - these are examples of "colimits." There's also an important class of constructions called "limits." Limits & colimits are concepts that make sense in any category. Say we have some category; we can ask if there are objects with some particular universal property.

**COLIMITS**

- **pushout**
  - Note that you can get from anywhere in this part both to $A+B$ and to $Q$ and there's a unique morphism from $A+B$ to $Q$ making the diagram commute.

- **coproduct**
  - Ditto for $A+B, Q$

- More general colimit
  - Ditto for $X, Q$

**LIMITS**

- **pullback**
  - Note that you can get to anywhere in this part both from $A+B$ and from $Q$ and there's a unique morphism $Q\to A+B$ making the diagram commute.

- **product**
  - Ditto for $A+B, Q$

- More general limit
  - Ditto for $X, Q$
Given sets $A, B$, I claim their (categorical) product is the cartesian product:

$$A \times B$$

Given any set $Q$ with functions $f_1: Q \to A$, $f_2: Q \to B$, there exists a unique function $f$ to the product such that this diagram commutes:

$$p_1(f(q)) = f_1(q)$$
$$p_2(f(q)) = f_2(q)$$
In Set, \( A + B \) is the disjoint union of \( A, B \):

"A function \( A \cup B \to Q \) is equivalent to a function \( A \to Q \) and a function \( B \to Q \)."