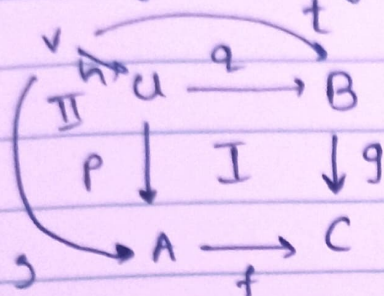


More universal properties

Pullbacks:

For a given objects A & B

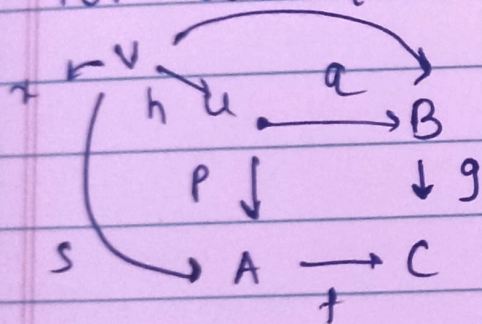


$u = A \times B$, (p & q are projection morphisms)

If the squares I & II commute for another object C , then there exists

a pullback h from $v \rightarrow u$ such that it is unique.

For sets: t



$a \in A$ & $b \in B$

$u = A \times B$.

iff

$\rightarrow \exists$ s.t. $\{(a, b) \in A \times B; f(a) = g(b)\}$
(has to commute)

$\rightarrow x \in v$

To show: $h(x) = (p(s(x)), t(x))$

$s(x) \in A$ & $t(x) \in B$

To prove: $f(s(x)) = g(t(x))$ (has to commute)

So, $(s(x), t(x)) \in A \times B$ from square II

and as x is an element in v .

This is uniquely mapped to $A \times B$ hence

$$h(x) = (s(x), t(x))$$

Pushouts:

dual of pullback