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regular map

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A regular map  $\phi : k^n \rightarrow k^m$  between affine spaces over an algebraically closed field is merely one given by polynomials. That is, there are  $m$  polynomials  $F_1, \dots, F_m$  in  $n$  variables such that the map is given by  $\phi(x_1, \dots, x_n) = (F_1(x), \dots, F_m(x))$  where  $x$  stands for the many components  $x_i$ .

A regular map  $\phi : V \rightarrow W$  between affine varieties is one which is the restriction of a regular map between affine spaces. That is, if  $V \subset k^n$  and  $W \subset k^m$ , then there is a regular map  $\psi : k^n \rightarrow k^m$  with  $\psi(V) \subset W$  and  $\phi = \psi|_V$ . So, this is a map given by polynomials, whose image lies in the intended target.

A regular map between algebraic varieties is a locally regular map. That is  $\phi : V \rightarrow W$  is regular if around each point  $x$  there is an affine variety  $V_x$  and around each point  $f(x) \in W$  there is an affine variety  $W_{f(x)}$  with  $\phi(V_x) \subset W_{f(x)}$  and such that the restriction  $V_x \rightarrow W_{f(x)}$  is a regular map of affine varieties.