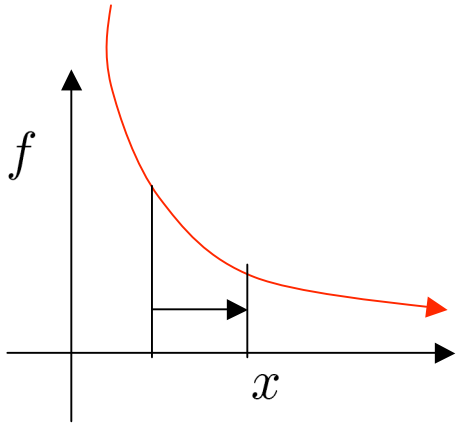
# Lecture 5: Jacobians

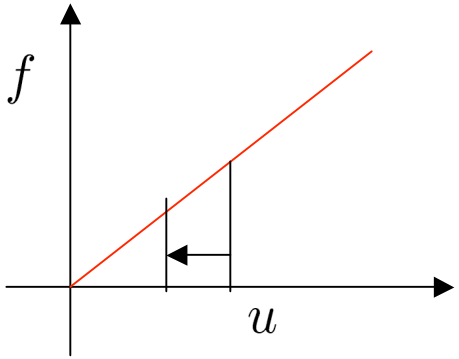
- In 1D problems we are used to a simple change of variables, e.g. from *x* to *u*

$$\int_a^b f(x)\mathrm{d}x = \int_\alpha^\beta f(x(u))\frac{\mathrm{d}x}{\mathrm{d}u}\mathrm{d}u$$

***1D Jacobian***

maps strips of width d*x* to strips of width d*u*




- Example: $\int_1^2 \frac{1}{x}\mathrm{d}x = \ln(2)$ Substitute $x = u^{-1} \rightarrow \frac{\mathrm{d}x}{\mathrm{d}u} = -u^{-2}$

$$= -\int_1^{\frac{1}{2}} \frac{u}{u^2}\mathrm{d}u = \left[\ln u\right]_{\frac{1}{2}}^{1} = \ln(2)$$