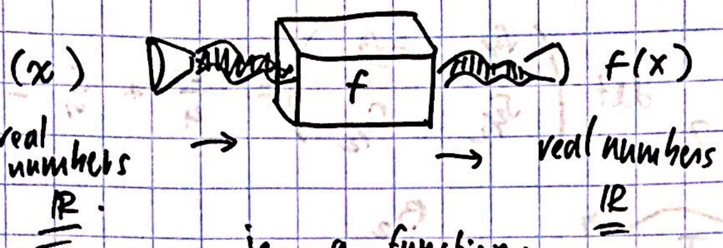
We have seen this before...

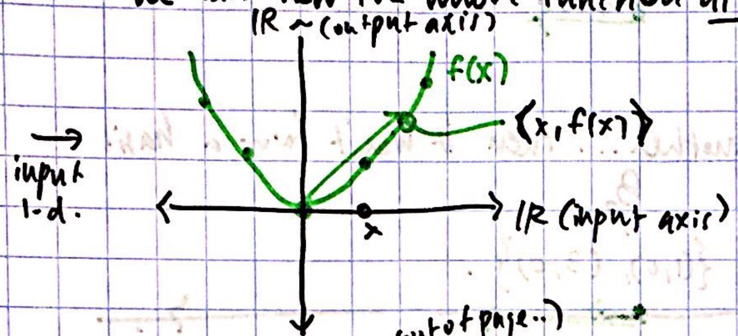
Imagine something that:



ie. a function...

x	f(x)
0	f(0)
1	f(1)
2	f(2)
⋮	⋮

We can continue to plug in single numbers & seeing what f(x) is...
But we can view the whole function at once... by looking with graph.

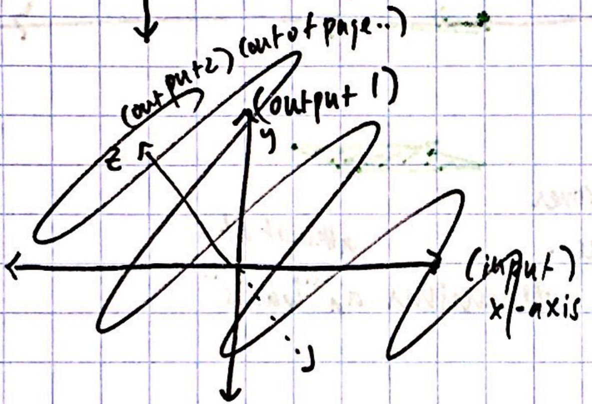


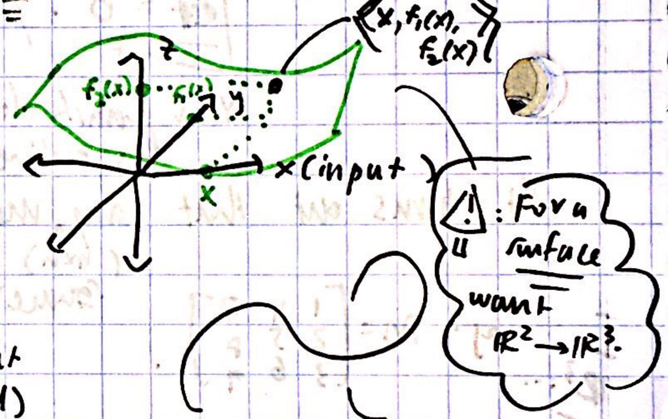
$f: \mathbb{R} \longrightarrow \mathbb{R}$

more generally...

$f: \mathbb{R} \longrightarrow \mathbb{R}^2$

$x \longmapsto (f_1(x), f_2(x))$

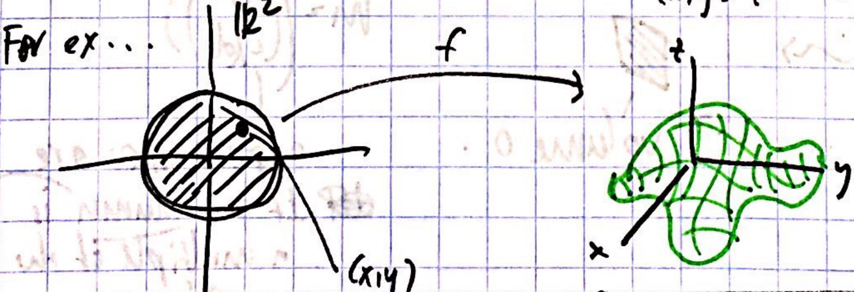




For a surface... you want a function $\mathbb{R}^2 \longrightarrow \mathbb{R}^3$.

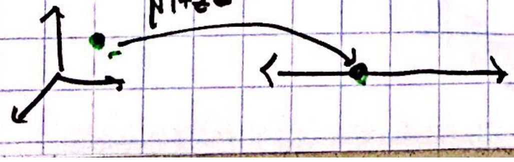
$(x,y) \longmapsto (f_1(x,y), f_2(x,y), f_3(x,y))$

For ex...



$f: \mathbb{R}^3 \longrightarrow \mathbb{R}^1$

$(x,y,z) \longmapsto \frac{xy}{\sqrt{1+z^2}}$

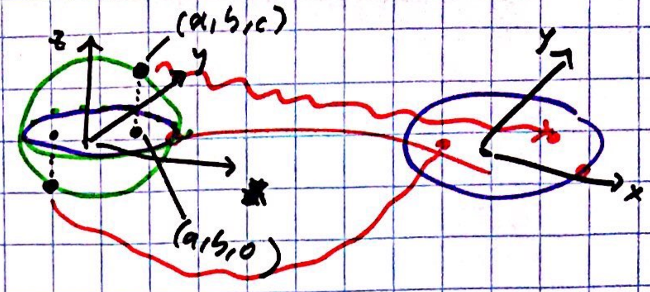


$g: \mathbb{R}^5 \longrightarrow \mathbb{R}^3$

$(x_1, \dots, x_5) \longmapsto (\underbrace{x_1 x_2}_{g_1}, \underbrace{x_2 x_3}_{g_2}, \underbrace{x_5^2}_{g_3})$

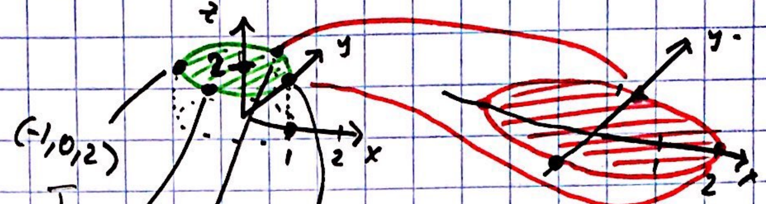
$F: \mathbb{R}^3 \longrightarrow \mathbb{R}^2$

$(x,y,z) \longmapsto (x,y)$



$F: \mathbb{R}^3 \longrightarrow \mathbb{R}^2$

$(x,y,z) \longmapsto (2x,y)$

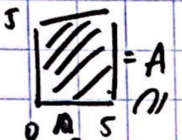


$(1,0,2) \longmapsto (2,0)$

$(0,1,2) \longmapsto (0,1)$

$(-1,0,2) \longmapsto (-2,0)$

$(0,-1,2) \longmapsto (0,-1)$



$\cong$

$\mathbb{R}^2 \longrightarrow \mathbb{R}^3$

$(x,y) \longmapsto (\underbrace{x}_{F_1(x,y)}, \underbrace{y}_{F_2(x,y)}, \underbrace{\sin(x)\sin(y)}_{F_3(x,y)})$

$F(A)$.

$B \subseteq \mathbb{R}^3$.

$\mathbb{R}^4 \xrightarrow{V} \mathbb{R}^3$

$(x,y,z,t) \longmapsto V(x,y,z,t) = (V_1(x,y,z,t), V_2(x,y,z,t), V_3(x,y,z,t))$

$V_1: \mathbb{R}^4 \to \mathbb{R}$, $V_2: \mathbb{R}^4 \to \mathbb{R}$, $V_3: \mathbb{R}^4 \to \mathbb{R}$.

Pick $(\underbrace{x,y,z}_{\text{pick a point in } \mathbb{R}^3 \text{ in } B}, \underbrace{t}_{\text{pick a time}})$

B.