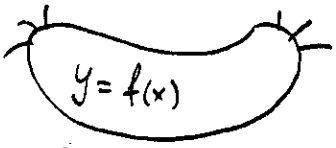
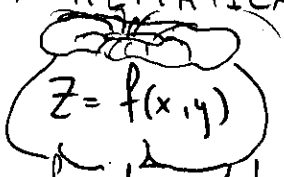
Vector fields

SPIRAL EVOLUTION OF MATHEMATICAL MODELING

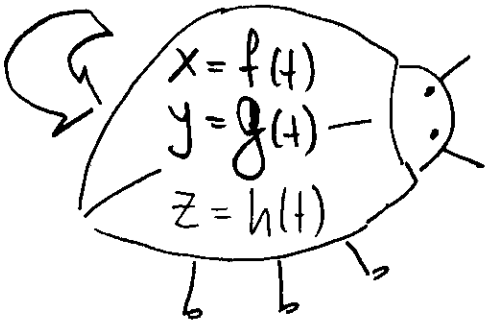


function of one variable

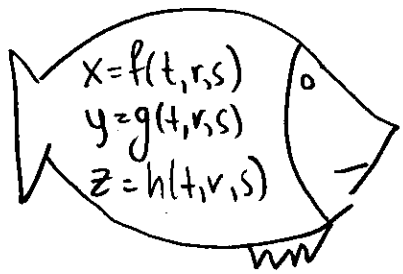


function of two and more variables

scalar functions (scalar means the value is a number)



vector function of one variable



Vector-function of two and more variables

vector-valued function

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \bar{\Phi}(t,r,s) = \begin{matrix} f(t,r,s) \\ g(t,r,s) \\ h(t,r,s) \end{matrix}$$

Most Commonly used notations:

$$\bar{v}(x,y,z) = (v_1(x,y,z),\ v_2(x,y,z),\ v_3(x,y,z))$$

is the same to say

$$\bar{v}(x,y,z) = \begin{pmatrix} v_1(x,y,z) \\ v_2(x,y,z) \\ v_3(x,y,z) \end{pmatrix}$$

or

$$v_1 = v_1(x,y,z)$$
$$v_2 = v_2(x,y,z)$$
$$v_3 = v_3(x,y,z)$$

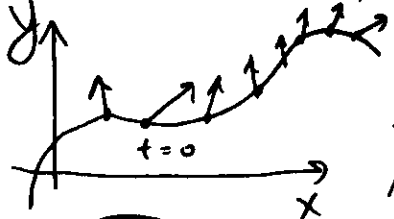
3-D vector function simply is a bundle of 3 functions $v_1(x,y,z), v_2(x,y,z), v_3(x,y,z)$ WITH conveniently CHOOSEN notations v_1, v_2, v_3 to show that that's a bundle

No matter how you write it, for each value of (x,y,z) this function associates with each value of (x,y,z) a vector (v_1, v_2, v_3)

VISUALISING:

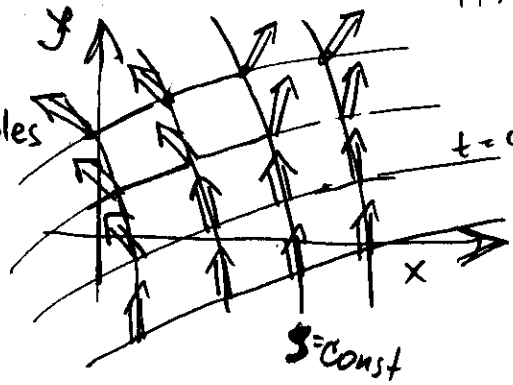
2-D vector function in one variable

$$\bar{v}(t) = (v_1(t), v_2(t))$$

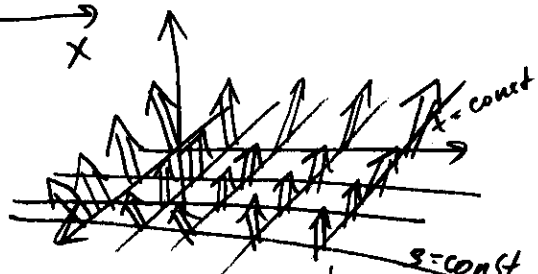


2-D vector function in two variables

$$\bar{v}(t,s) = v_1(t,s),\ v_2(t,s)$$



3-D vector function IN 2-variables



Vector Fields