## Courbes dans le ~~plan~~ espace:

- $r(t) = [x(t), y(t), z(t)] = x(t)\vec{i} + y(t)\vec{j} + z(t)\vec{k}$

- Cercle = $x^2 + y^2 = 4$ $\rightarrow$ $r(t) = [a\cos(t), a\sin(t), 0]$
- Elipse = $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ $\rightarrow$ $r(t) = [a\cos(t), b\sin(t), 0]$
- Ligne droite = $\rightarrow$ $r(t) = bt + a$
- hélix Circulaire = $x^2 + y^2 = a^2$ $\rightarrow$ $r(t) = [a\cos(t), a\sin(t), Ct]$

- Tangente à la Courbe $\rightarrow$ $U = \frac{1}{|r'|} r'$

Longueur Courbe
- $l = \int_a^b \sqrt{r' \cdot r'}\, dt$ $\rightarrow$ $r' = \frac{dr}{dt}$

Longueur S Courbe
- $S(t) = \int_a^t \sqrt{r' \cdot r'}\, d\tau$ $\rightarrow$ $r' = \frac{dr}{d\tau}$
- $ds^2 = dr \cdot dr = dx^2 + dy^2 + dz^2$

## Surfaces dans l'espace:

- $r(u,v) = [x(u,v), y(u,v), z(u,v)] = x(u,v)\vec{i} + y(u,v)\vec{j} + z(u,v)\vec{k}$

- Sphere = $r(u,v) = a\cos(u)\cos(v)\vec{i} + a\cos(v)\sin(u)\vec{j} + a\sin(v)\vec{k}$
- Cylindre = $r(u,v) = a\cos(u)\vec{i} + a\sin(u)\vec{j} + v\vec{k}$

- $r_u = \frac{\partial r}{\partial u}$
- $r_v = \frac{\partial r}{\partial v}$

Normale
- $N = r_u \times r_v \neq 0$

Normale unitaire
- $n = \frac{1}{|N|} N = \frac{1}{|r_u \times r_v|}(r_u \times r_v)$ $\rightarrow$ Pour $r(u,v)$

- $n = \frac{1}{|\text{grad}\, g|} \text{grad}\, g$ $\rightarrow$ pour $g(x,y,z) = 0$

- Equation du plan tangent à la surface $= \left[\frac{\partial F}{\partial x}\right]_{(a,b,c)}(x-a) + \left[\frac{\partial F}{\partial y}\right]_{(a,b,c)}(y-b) + \left[\frac{\partial F}{\partial z}\right]_{(a,b,c)}(z-c) = 0$

- Equation de la droite normale $= \frac{(x-a)}{\left[\frac{\partial F}{\partial x}\right]_{(a,b,c)}} = \frac{(y-b)}{\left[\frac{\partial F}{\partial y}\right]_{(a,b,c)}} = \frac{(z-c)}{\left[\frac{\partial F}{\partial z}\right]_{(a,b,c)}}$

## Champs scalaire et vectoriel :

- $V = v(P) = [v_1(P), V_2(P), V_3(P)]$
- fonction scalaire $= f(P) = f(x,y,z) = \sqrt{(x-x_0)^2 + (y-y_0)^2 + (z-z_0)^2}$

- $V(x,y,z) = w \times r = w \times [x,y,z] = w \times (x\vec{i} + y\vec{j} + z\vec{k})$

ligne de Champ

- $\frac{d\vec{r}}{dt} = \lambda \vec{V}(\vec{r})$

- $\frac{d\vec{r}}{ds} = \vec{V}(\vec{r})$

- $\frac{dx}{ds} = V_x(x,y,z)$ ou $\frac{dy}{ds} = V_y(x,y,z)$ ou $\frac{dz}{ds} = V_z(x,y,z)$