

# CALCULUS OF CURVES PART 1

$$t \mapsto \vec{r}(t) = \langle x_1(t), \dots, x_n(t) \rangle$$

$n=2$   $\vec{r}(t) = \langle x(t), y(t) \rangle$

Def<sup>n</sup>  $\frac{d\vec{r}}{dt} = \left\langle \frac{dx}{dt}, \frac{dy}{dt} \right\rangle$   
 $\int_a^b \vec{r}(t) dt = \left\langle \int_a^b x dt, \int_a^b y dt \right\rangle$

$$\vec{r}(t) = \langle t, t^2 \rangle$$

$$\frac{d\vec{r}}{dt} = \left\langle \frac{dt}{dt}, \frac{d(t^2)}{dt} \right\rangle = \langle 1, 2t \rangle$$

$$\int \vec{r}(t) dt = \left\langle \int t dt, \int t^2 dt \right\rangle = \left\langle \frac{1}{2}t^2 + C_1, \frac{1}{3}t^3 + C_2 \right\rangle = \left\langle \frac{1}{2}t^2, \frac{1}{3}t^3 \right\rangle + \vec{C}$$

→ speed =  $\left\| \frac{d\vec{r}}{dt} \right\| = \sqrt{1 + 4t^2}$