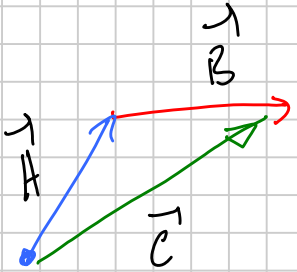
Lecture 4. Decomposition of vectors. Decomposition of motion in 2D.

Note Title 9/12/2011

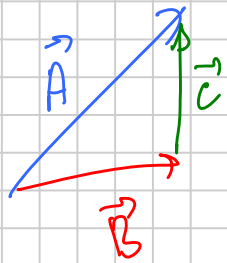
$$v = \frac{dx}{dt} \qquad a = \frac{dv}{dt}$$

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

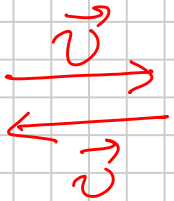
$$v = v_0 + at$$

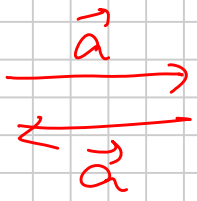


$$\vec{C} = \vec{A} + \vec{B}$$



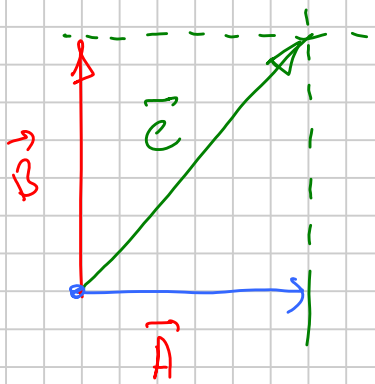
$$\vec{C} = \vec{A} - \vec{B}$$

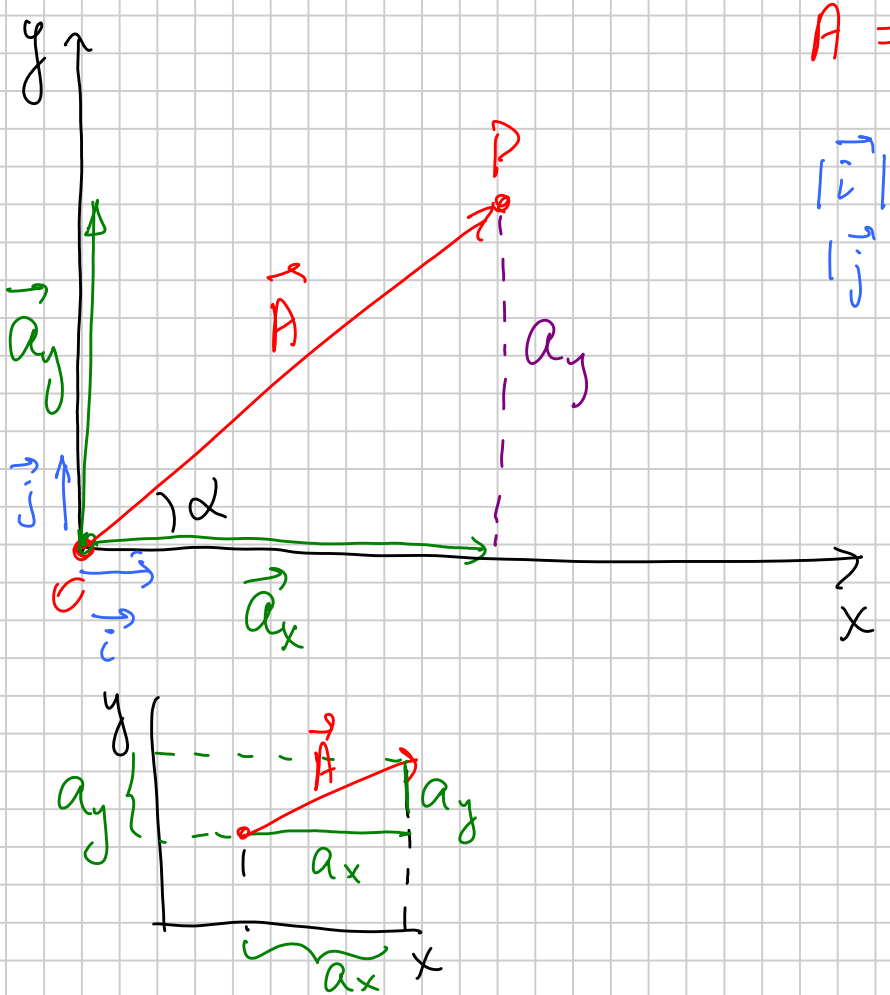




Decomposition of vectors

$$\vec{C} = \vec{A} + \vec{B}$$





$$\vec{A} = \vec{a}_x + \vec{a}_y = a_x \vec{i} + a_y \cdot \vec{j}$$

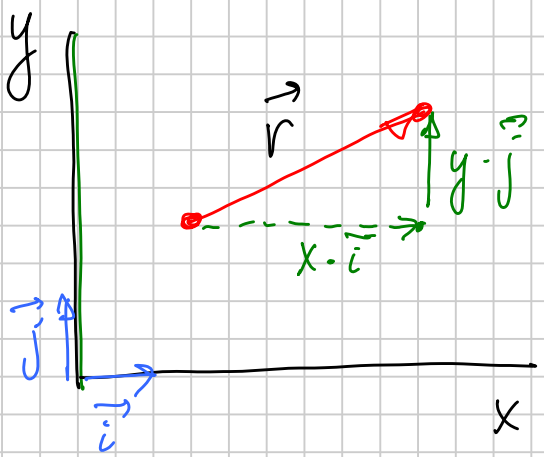
$|\vec{i}| = 1$ $\quad \vec{a}_x = \vec{i} \cdot |\vec{a}_x| = a_x \vec{i}$

$|\vec{j}| = 1$ $\quad \vec{a}_y = \vec{j} \cdot |\vec{a}_y| = a_y \cdot \vec{j}$

$$|\vec{A}| = \sqrt{a_x^2 + a_y^2}$$

$$a_x = |\vec{A}| \cos\alpha$$

$$a_y = |\vec{A}| \sin\alpha$$



$$\vec{r} = x \cdot \vec{i} + y \cdot \vec{j}$$

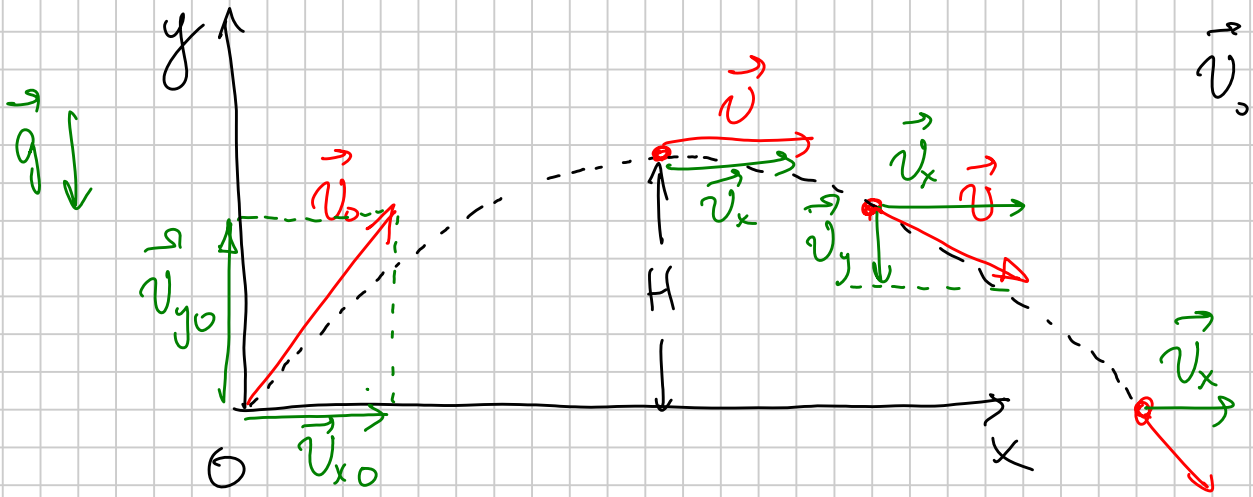
$$\vec{v} = \frac{d\vec{r}}{dt} = \frac{dx}{dt} \cdot \vec{i} + \frac{dy}{dt} \cdot \vec{j}$$

$$v_x = \frac{dx}{dt} \qquad v_y = \frac{dy}{dt}$$

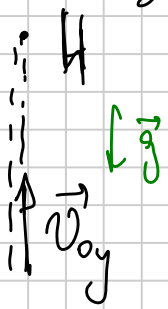
$$\vec{r} = x \cdot \vec{i} + y \cdot \vec{j} + z \cdot \vec{k}$$

$$\vec{v} = \frac{dx}{dt} \cdot \vec{i} + \frac{dy}{dt} \cdot \vec{j} + \frac{dz}{dt} \cdot \vec{k} = v_x \cdot \vec{i} + v_y \vec{j} + v_z \cdot \vec{k}$$

$$\vec{a} = \frac{d^2x}{dt^2} \cdot \vec{i} + \frac{d^2y}{dt^2} \cdot \vec{j} + \frac{d^2z}{dt^2} \cdot \vec{k} = a_x \vec{i} + a_y \vec{j} + a_z \cdot \vec{k}$$



$$\vec{v}_0 = \vec{v}_{x0} + \vec{v}_{y0}$$



1D: $v_y = v_{0y} + a_y t$

$v_y = v_{0y} - gt$

x	y
$t=0$ v_{x0}	$t=0$ v_{y0}
$v_x = v_{x0}$ for any t	$v_y = v_{y0} - gt$
$x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$	$y=H$: $v_y = 0 \Rightarrow v_{y0} = gt$ $\quad t = \frac{v_{y0}}{g}$
$x = x_0 + v_{0x}t$	$y = y_0 + v_{0y}t - \frac{1}{2}gt^2$

$$v_x = v_{0x} + a_x t$$