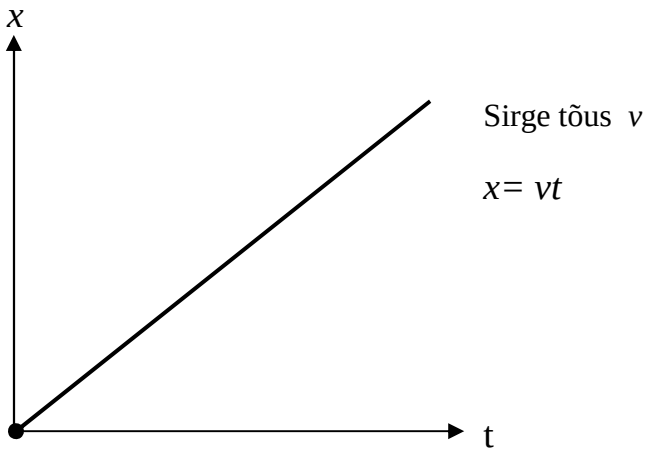
KINEMATICS: the dependences of the coordinate *x*, velocity *v* and acceleration *a* on the time *t*.

1. Uniform motion along the straight line, v = const.

a) The initial coordinate $x_0 = 0$



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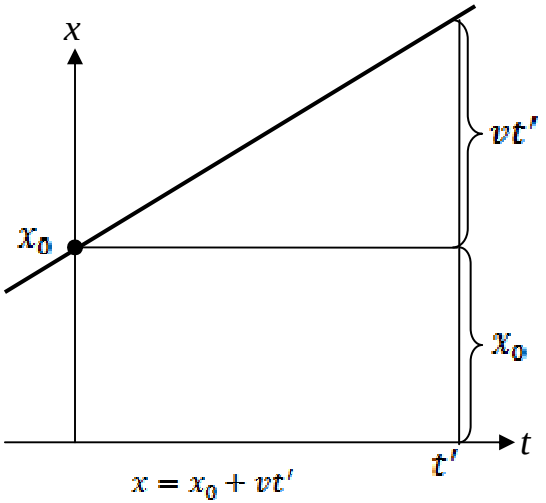
$x = vt$

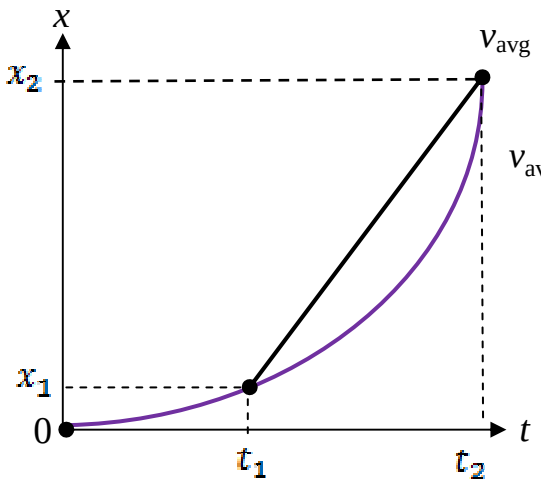
b) The initial coordinate $x_0 \neq 0$



$x = x_0 + vt'$

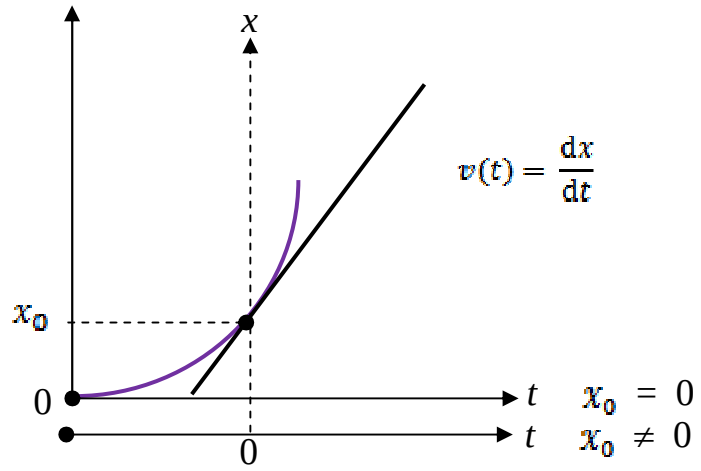
2. Non-uniform motion with a constant acceleration, a = const.

a) The slope of the line segment is the <u>average velocity</u> v_{avg}



$$v_{avg} = \frac{x_2 - x_1}{t_2 - t_1} = \frac{\Delta x}{\Delta t}$$

b) The <u>instantaneous velocity</u> $v(t)$ is the time derivative of the coordinate x.

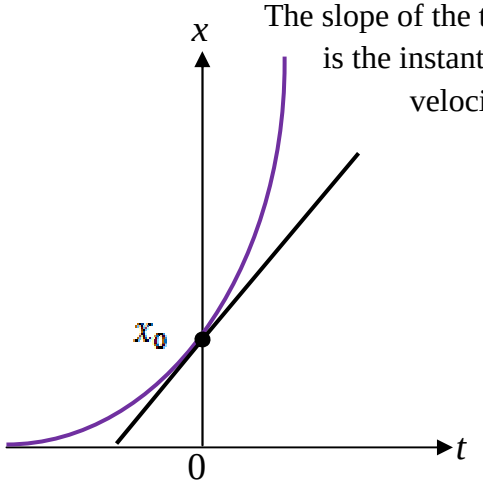


$$v(t) = \frac{dx}{dt}$$

$x_0 = 0$

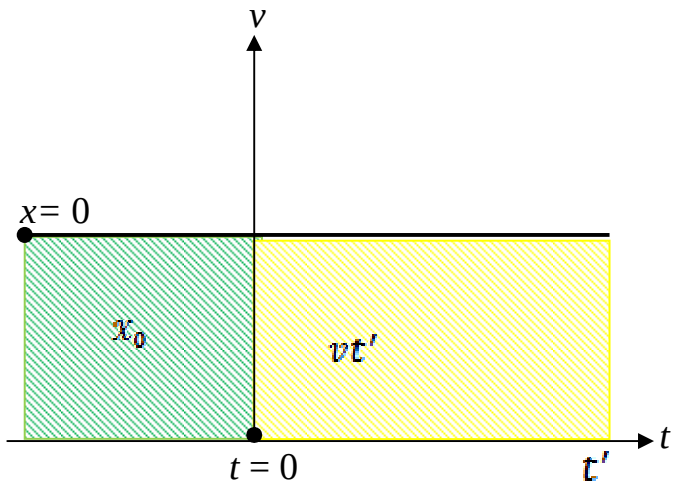
$x_0 \neq 0$

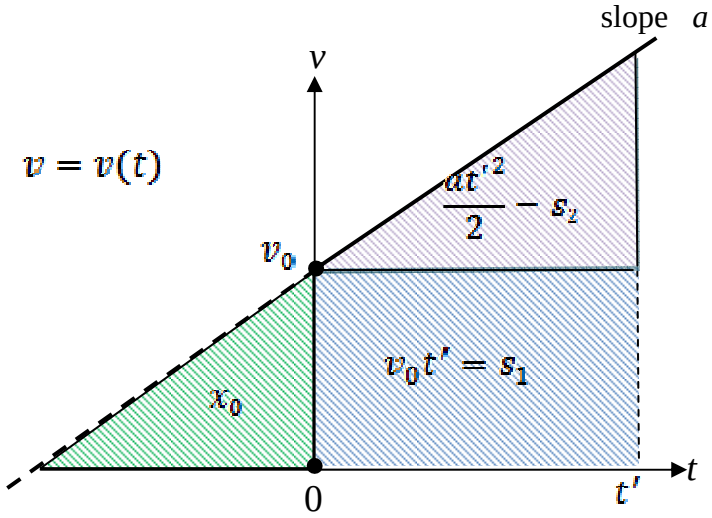
3. Non-uniform motion with a linear change of the acceleration, $a = a_0 + b\,t$

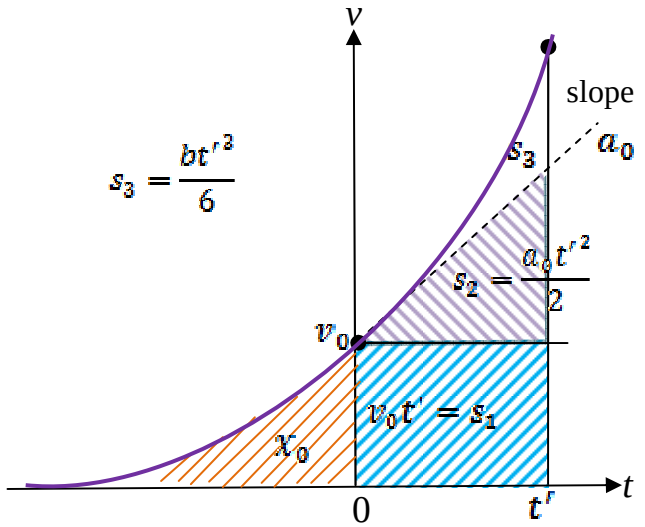


The slope of the tangent is the instantaneous velocity v (t)

B. The dependence of the velocity on the time $v = v(t)$







C. The dependence of the acceleration on the time $a = a(t)$