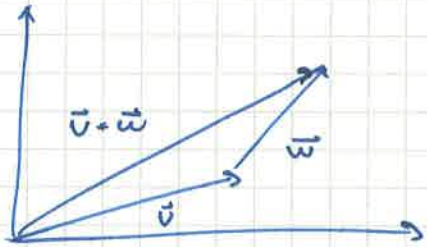
Vectors

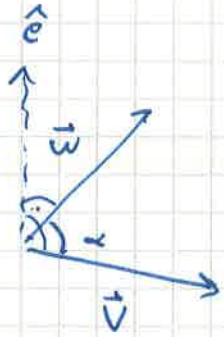
$\vec{v} = (v_x, v_y, v_z)$ $\quad |\vec{v}| = \sqrt{v_x^2 + v_y^2 + v_z^2}$

$\vec{v} + \vec{w} = (v_x + w_x, v_y + w_y, v_z + w_z)$



$a\vec{v} = (av_x, av_y, av_z)$

$\vec{v} \cdot \vec{w} = |\vec{v}||\vec{w}| \cos\alpha \cdot x$



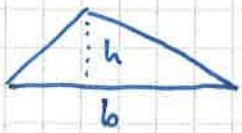
$\vec{v} \times \vec{w} = |\vec{v}||\vec{w}| \sin\alpha \, \hat{e} \cdot \vec{x}$

Geometry

Area

a^2

ab

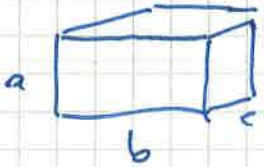


$\frac{bh}{2}$

πr^2

Volume

a^3

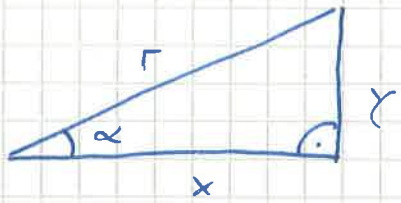


abc

$\frac{abh}{3}$

$\frac{4}{3}\pi r^3$

Trigonometry



$$\sin\alpha = \frac{y}{r}$$

$$\cos\alpha = \frac{x}{r}$$

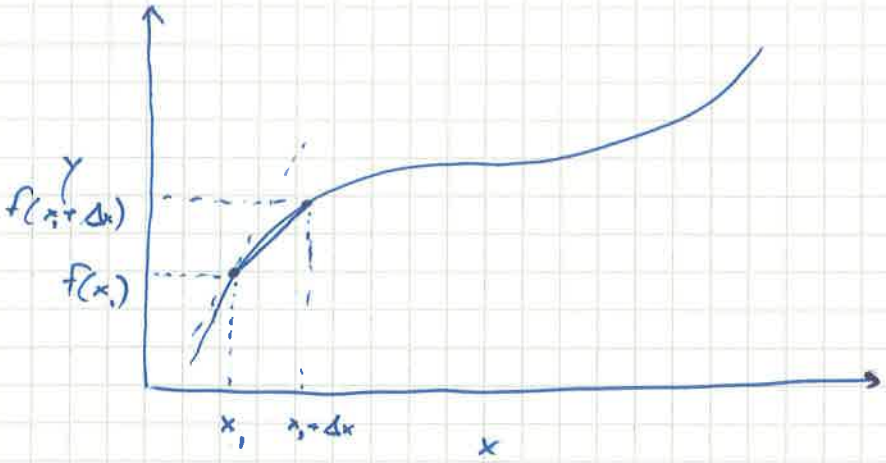
$$\tan\alpha = \frac{y}{x} \quad \cdot \quad \frac{\sin\alpha}{\cos\alpha}$$

$$x^2 + y^2 = r^2$$

$$\frac{x^2}{r^2} + \frac{y^2}{r^2} = \frac{r^2}{r^2}$$

$$\cos^2\alpha + \sin^2\alpha = 1$$

Derivatives



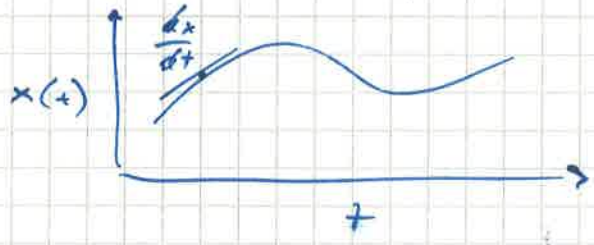
$y = f(x)$

$$\frac{\Delta y}{\Delta x} = \frac{f(x_1 + \Delta x) - f(x_1)}{\Delta x}$$

$$y' = \lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} = \frac{dy}{dx}$$

$$y' = \frac{dy}{dx}$$

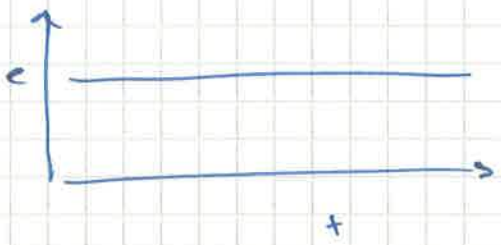
$$y'' = \frac{d}{dx}\left(\frac{dy}{dx}\right) = \frac{d^2y}{dx^2}$$



velocity $\rightarrow \frac{dx}{dt} = \dot{x}$

acceleration $\rightarrow \frac{d^2x}{dt^2} = \ddot{x}$

$$\frac{d\,c}{dt} = 0 \qquad \text{(c ← constant)}$$



—

$$\frac{d}{dt}\left(c \cdot f(t)\right) = c \cdot \frac{df(t)}{dt}$$

—

$$\frac{d}{dt}\left(f(t) + g(t)\right) = \frac{df(t)}{dt} + \frac{dg(t)}{dt}$$

—

$$\frac{d}{dt}\, f(x(t)) = \frac{df}{dx} \cdot \frac{dx}{dt}$$

—

$$\frac{d}{dt}\left(f(t) \cdot g(t)\right) = \frac{df(t)}{dt} \cdot g(t) + f(t) \cdot \frac{dg(t)}{dt}$$

—

$$\frac{d\vec{v}}{dt} = [\text{illegible}] = \left(\frac{dv_x}{dt}, \frac{dv_y}{dt}, \frac{dv_z}{dt}\right)$$

$$\dot{\vec{v}} = \left(\dot{v}_x, \dot{v}_y, \dot{v}_z\right)$$

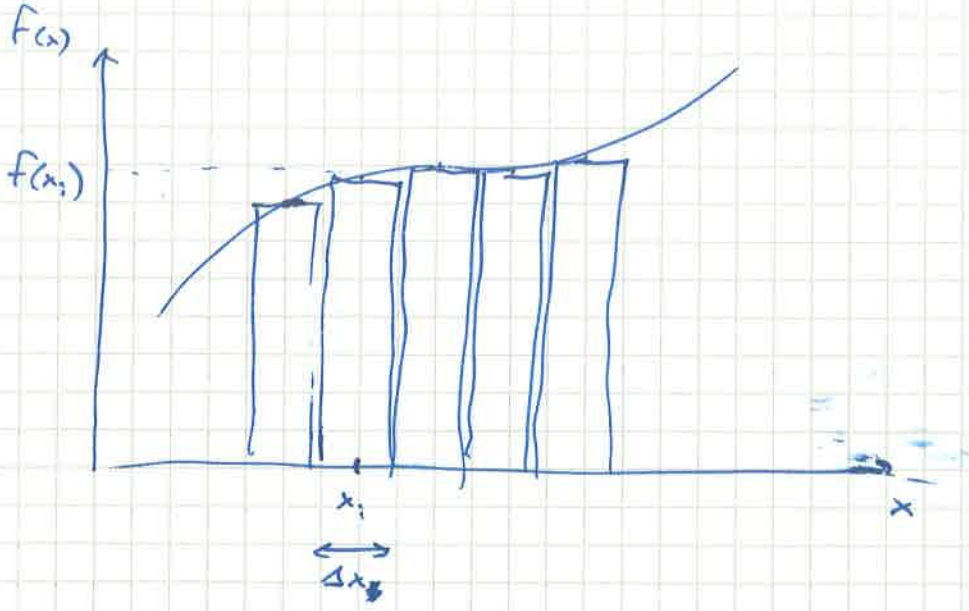
$$\frac{d(t^n)}{dt} = n t^{n-1}$$

$$\frac{d}{dt} \sin(\omega t) = \omega \cos(\omega t)$$

$$\frac{d}{dt} e^{at} = a e^{at}$$

$$\vdots$$

Integrals



$$\text{Area} = \lim_{\Delta x_i \to 0} \sum_i f(x_i)\,\Delta x_i = \int f(x)\,dx$$

$$g(x) = \int f(x)\,dx = \lim_{\Delta x_i \to 0} \sum_i f(x_i)\,\Delta x_i$$

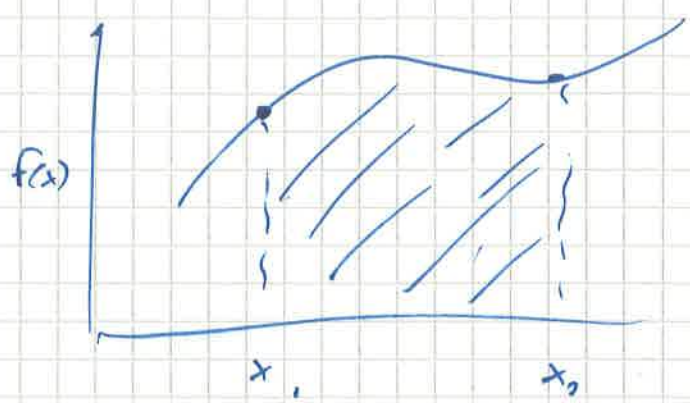
$$g(x) = \sum_i \underbrace{\left(\lim_{\Delta x_i \to 0} f(x_i)\,\Delta x_i \right)}_{\Delta g}$$

$$\Delta g = \lim_{\Delta x \to 0} f(x_i)\,\Delta x = f(x) \lim_{\Delta x \to 0} \Delta x$$

$$f(x) = \lim_{\Delta x \to 0} \frac{\Delta g}{\Delta x} = \frac{d\,g(x)}{dx}$$

$$f(x) = \frac{d\,g(x)}{dx} \quad \longleftrightarrow \quad g(x) = \int f(x)\,dx$$

$$\int_{x_1}^{x_2} f(x)\,dx = g(x_2) - g(x_1)$$



$$\int C\,dt = At$$

$$\int At^n\,dt = A\frac{t^{n+1}}{n+1}, \quad n \neq -1$$

$$\int e^{at}\,dt = \frac{1}{a}e^{at}$$

$$\int \cos(\omega t)\,dt = \frac{1}{\omega}\sin(\omega t)$$