3) 1) $f(x,y) = x^2 + y^2$ $\qquad x^2+y^2 \leq 4 \iff r \leq 2$

$f_x = 2x$ $\qquad \sqrt{1+f_x^2+f_y^2} = \sqrt{1+4x^2+4y^2} =$

$f_y = 2y$ $\qquad = \sqrt{1+4r^2}$

$x = r\cos\varphi$

$y = r\sin\varphi$

$J = r$

$$\int_0^{2\pi}\int_0^2 r\sqrt{1+4r^2}\,dr\,d\varphi =$$

$$= \int_0^{2\pi} \frac{1}{12}\left(17^{\frac{3}{2}} - 1\right) d\varphi = \frac{\pi}{6}\left(17\cdot\sqrt{17} - 1\right)$$

$$\int r\sqrt{1+4r^2} = \frac{1}{2}\int\sqrt{1+4s} = \frac{1}{2}\cdot\frac{2}{3}\cdot\frac{1}{4}(1+4s)^{\frac{3}{2}} =$$

$s = r^2$

$$= \frac{1}{12}\left(1+4r^2\right)^{\frac{3}{2}}$$

$ds = 2r\,dr$

$$\int_0^2 r\sqrt{1+4r^2} = \frac{1}{12}\left[\left(1+4r^2\right)^{\frac{3}{2}}\right]_0^2 = \frac{1}{12}\left(17^{\frac{3}{2}} - 1\right)$$

$$\frac{dy}{1+y} = \frac{dx}{1+x^2}$$

$$\ln|1+y| = \operatorname{arctg} x + c$$

$$y = k e^{\operatorname{arctg} x} - 1$$

$$dm = -\frac{m}{V} \cdot \underbrace{v \cdot dt}_{dV}$$

$$\frac{dm}{m} = -\frac{v}{V} dt$$

$$dm = -\lambda m \quad , \quad \lambda \in \mathbb{R}^+$$

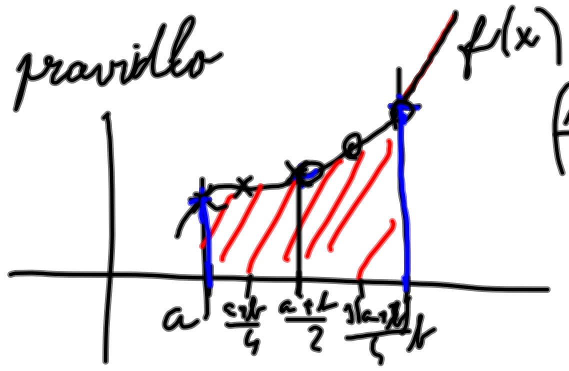
$$\sin x \doteq x - \frac{x^3}{6} + \frac{x^5}{120}$$

$$1 - \cos(1)$$

$$\int_0^1 \sin x \, dx \doteq \int_0^1 \left(x - \frac{x^3}{6} + \frac{x^5}{120}\right) dx =$$

$$= \left[\frac{x^2}{2} - \frac{x^4}{4!} + \frac{x^6}{6!} \right]_0^1 = \frac{1}{2} - \frac{1}{4!} + \frac{1}{6!}$$

Simpsonovo pravidlo



$$\left(\frac{b-a}{6}\right) \cdot \left(f(a) + 4 \cdot f\left(\frac{a+b}{2}\right) + f(b)\right)$$

$$y'(t) = \lim_{h \to 0} \frac{y(t+h) - y(t)}{h} \simeq \frac{y(t+\Delta) - y(t)}{\Delta} \Rightarrow$$

$$y(t+\Delta) = y(t) + \Delta \underbrace{y'(t)}_{\frac{1}{1+t^2}}$$

$$y'(0) = \frac{1}{1+0^2} = 1 \quad , \quad y(0) = 0$$

$$y(\Delta) = y(0) + \Delta \cdot \frac{1}{1+0^2} \qquad h := \Delta$$

$$y(n \cdot h) = y((n-1)h) + h \cdot \frac{1}{1+((n-1)h)^2}$$

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