Rješenja primjera 1. kol. iz Matematike 2.

1. (i) $\int f(x)\,dx = F(x)+C$ znači $(F(x)+C)' = f(x)$
tj. $\underline{F' = f}$.

(ii) Treba provjeriti je li $\left[\ln(x+\sqrt{x^2+1})\right]' = \frac{1}{\sqrt{x^2+1}}$.
Jeste (pogledajte izvod u lekciji 1.)

(iii) $y'(t) = -k\,y(t)$.
Tu je t vrijeme i $y(t)$ količina radioakt. materije u vrijeme t. Jednadžba proizlazi iz približne jednakosti $\Delta y(t) \simeq -k \cdot y(t)\,\Delta t$ koja govori da je količina raspadnute materije u intervalu $[t, t+\Delta t]$ približno proporcionalna Δt i količini materije $y(t)$. Konstanta $k>0$ je karakteristika materije.

2. (i) $\int u\,dv = uv - \int v\,du$

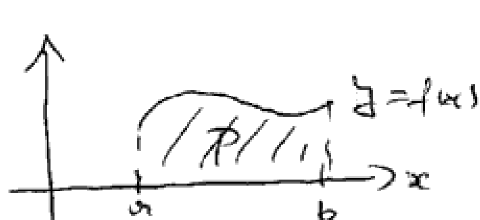
(ii)
$$\int x e^{-2x}dx = \begin{bmatrix} u=x, & du=dx \\ dv = e^{-2x}dx; & v = -\frac{1}{2}e^{-2x}\end{bmatrix}$$
$$= x\cdot\left(-\frac{1}{2}e^{-2x}\right) - \int\left(-\frac{1}{2}e^{-2x}\right)dx$$
$$= \underline{\underline{-\frac{1}{2}xe^{-2x} - \frac{1}{4}e^{-2x} + C}}$$

(iii) To je formula
$$\int u(x)\,v'(x)\,dx = u(x)\,v(x) - \int v(x)\,u'(x)\,dx$$
i izvede se iz $[u(x)\cdot v(x)]' = u'(x)v(x) + u(x)v'(x)$

(vidi lekciju 2.).

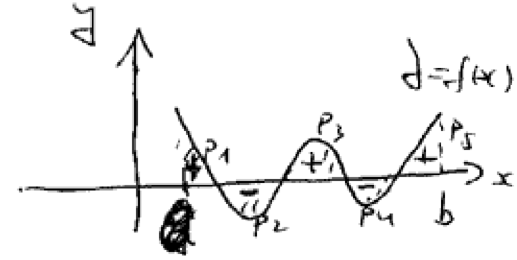
3.

(i)



Integral pozitivne funkcije f na segmentu $[a,b]$ jednak je površini između grafa funkcije i osi x.

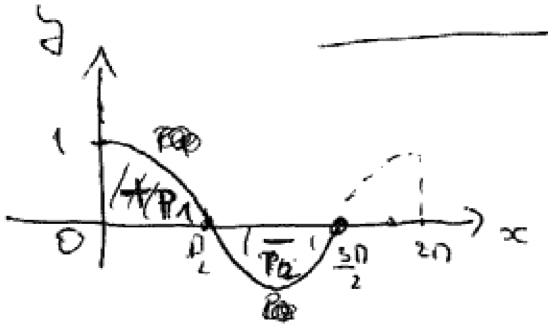
$$P = \int_a^b f(x)\,dx$$



Integral funkcije f na segmentu $[a,b]$ jednak je razlici površine između grafa funkcije i osi x koji je iznad osi x i površine ispod osi x.

$$\int_a^b f(x)\,dx = P_1 - P_2 + P_3 - P_4 + P_5$$

(ii)



$$\int_0^{\frac{3\pi}{2}} \cos x\,dx = \sin x \Big|_0^{\frac{3\pi}{2}}$$

$$= \sin\frac{3\pi}{2} - \sin 0$$

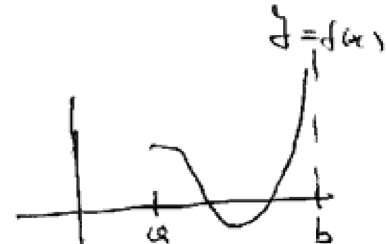
$$= -1 - 0$$

$$= \underline{\underline{-1}}$$

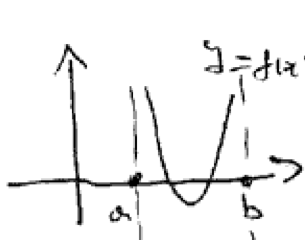
Dakle $P_1 - P_2 = -1$.

4. (i)

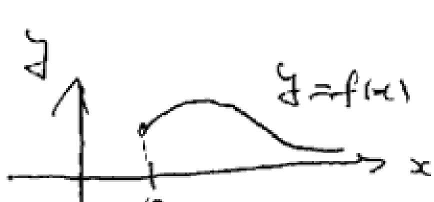
f nije definirana u a



f nije definirana u b

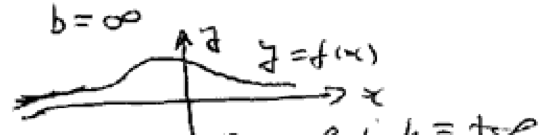


f nije definirana ni u a ni u b



$b=\infty$

$a=-\infty$



$a=-\infty$ i $b=+\infty$

(ii) Iz 2 (ii) dobijemo

$$\int_0^\infty x e^{-2x}\,dx = \left(-\frac{1}{2} x e^{-2x} - \frac{1}{4} e^{-2x}\right)\Big|_0^\infty = -\frac{1}{2}\frac{x}{e^{2x}}\Big|_0^\infty - \frac{1}{4}\cdot e^{-2x}\Big|_0^\infty$$

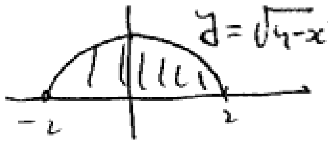
$$= (0-0) - \left(0 - \frac{1}{4}\right) = \frac{1}{4}$$

(pogledajte lekciju 4.)

(iii)
$$\int_{-2}^{2} \sqrt{4-x^2}\,dx = \left[\begin{array}{ll} x = 2\sin t & ;\ x=2,\ t=\frac{\pi}{2} \\ dx = 2\cos t\,dt & ;\ x=-2;\ t=-\frac{\pi}{2} \end{array}\right]$$

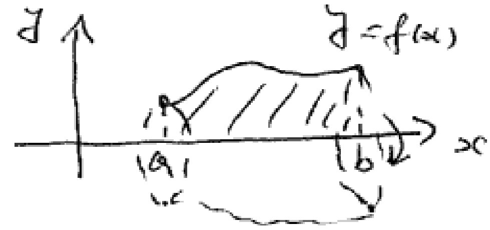
$$= \int_{-\pi/2}^{\pi/2} \sqrt{4-4\sin^2 t}\cdot 2\cos t\,dt = 4\int_{-\pi/2}^{\pi/2} \cos^2 t\,dt$$

(iv) $\int_{-2}^{2} \sqrt{4-x^2}\,dx = 2\pi$ jer je to polovica površine kruga polumjera $r=2$.



Može se i nastaviti računati integral iz (iii).

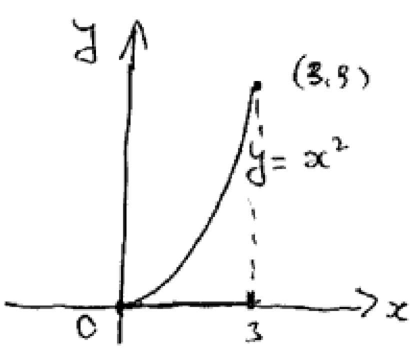
5. (i) $V = \pi\int_a^b f^2(x)\,dx$



(ii) Vidi lekciju 5.

(iii) $m = \int_a^b \rho(x)\,dx$

(iv)



$$m = \int_0^3 x^2\,dx = \frac{x^3}{3}\Big|_0^3 = 9$$