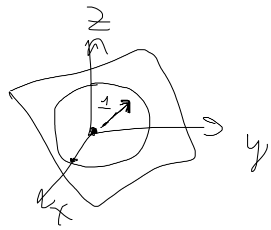
$$\text{T2. а) } p\Gamma(p)=\Gamma(p+1) \Rightarrow p\Gamma(p)\to 1,\ p\to 0 \Rightarrow \Gamma(p)\sim\frac{1}{p},\ p\to 0$$

$$\text{T3. а) } \int_0^{\pi} dy \int_y^{\pi} \frac{\sin x}{x}\,dx = \int_0^{\pi} dx\,\frac{\sin x}{x}\int_0^{x} dy = \int_0^{\pi} \sin x\,dx = 2$$

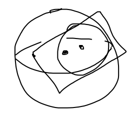
$$\text{в) } \int\limits_{0\le x_1\dots x_n\le a} (x_1+\dots+x_n)^2\,dx_1\dots dx_n = a^{n-1}\int_0^a x^2\,dx\cdot n + 2na^{n-2}\iint\limits_{0\le x,y\le a} xy\,dx\,dy = 2na^{n-2}\left(\int_0^a x\,dx\right)^2 + a^{n-1}n\int_0^a x^2\,dx =$$

$$= 2na^{n-2}\left(\frac{a^2}{2}\right)^2 + na^{n-1}\frac{a^3}{3} = \frac{na^{n+2}}{2} + \frac{na^{n+2}}{3} = \frac{5na^{n+2}}{6}$$

$$\text{T.7. б) } \int\limits_{\substack{x^2+y^2+z^2=a^2\\ x+y+z=0}} x^2\,ds = I \Rightarrow 3I = \int\limits_{\substack{x^2+y^2+z^2=a^2\\ x+y+z=0}} x^2+y^2+z^2\,ds = \int\limits_{\substack{x+y+z=0\\ x^2+y^2+z^2=0}} a^2\,ds = a^2\int_S ds = 2\pi a^2$$



$$\text{T.4. б) б) } \iiint\limits_{x^2+y^2+z^2\leqslant a^2} f(x+y+z)\,dxdydz; = \left\{\begin{array}{l} t=x+y+z \\ y=y \\ z=z \end{array}\right\} \iiint\limits_{h} f(t)\,dt\,dy\,dz = \int_0^a dt\, f(t)\,\pi(a^2-t^2)$$



T.1. а) $\int_0^{+\infty} x^{\alpha-1}e^{-x^\beta}dx$, сход при $\alpha,\beta>0$ и $\alpha,\beta<0$

$$\int_0^{+\infty} x^{\alpha-1}e^{-x^\beta}dx = \left\{\begin{array}{l} t=x^\beta \\ dx=\frac{1}{\beta}t^{\frac{1}{\beta}-1}dt \end{array}\right\} = \int_0^{+\infty} t^{\frac{\alpha-1}{\beta}} e^{-t}\frac{1}{\beta}t^{\frac{1}{\beta}-1}dt = \frac{1}{\beta}\int_0^{+\infty} t^{\frac{\alpha}{\beta}-1}e^{-t}dt = \frac{1}{\beta}\Gamma\left(\frac{\alpha}{\beta}\right)$$

$$\text{в) } \int_0^{+\infty} \frac{x^\alpha \ln x}{1+x^\beta}dx = \left\{\begin{array}{l} x^\beta=t \\ dx=\frac{1}{\beta}t^{\frac{1}{\beta}-1} \end{array}\right\} = \frac{1}{\beta^2}\int_0^{+\infty} \frac{t^{\frac{\alpha+1}{\beta}-1}\ln t}{1+t}dt = \frac{1}{\beta^2}\int_0^{+\infty}\frac{t^{\gamma-1}\ln t}{1+t}dt \qquad \left\{\gamma=\frac{\alpha+1}{\beta}\right\}$$

$$\int_0^{+\infty}\frac{t^{\gamma-1}\ln t}{1+t}dt = \left\{\begin{array}{l} \ln t = p \\ dt = e^p dp \end{array}\right\} = \int_{-\infty}^{+\infty}\frac{e^{\gamma p}\,p}{1+e^p}dp$$

$$\text{Р-рим } \frac{\pi}{\sin(\pi\gamma)} = B(\gamma,1-\gamma) = \int_0^{+\infty}\frac{t^{\gamma-1}}{1+t}dt = \int_{-\infty}^{+\infty}\frac{e^{\gamma p}}{1+e^p}dp$$

$$-\frac{\pi^2\cos(\pi\gamma)}{\sin^2(\pi\gamma)} = \int_{-\infty}^{+\infty}\frac{pe^{\gamma p}}{1+e^p}dp \Rightarrow \int_0^{+\infty}\frac{x^\alpha \ln x}{1+x^\beta}dx = -\frac{\pi^2\beta^2\cos(\pi\gamma)}{\sin^2(\pi\gamma)}$$

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