(13) $y=\sqrt{1-y^2}$ $\quad y=\sqrt{4-x^2}$

$x^2+y^2=1 \quad x^2+y^2=4 \qquad \theta\in[0,\pi] \quad \rho=kr$

$r=1 \quad r=2$

$$m=\int_0^\pi\int_1^2 kr^2\,dr\,d\theta = k\int_0^\pi d\theta\int_1^2 r^2\,dr = \pi k\left(\frac{8}{3}-\frac{1}{3}\right)=\frac{7\pi}{3}k$$

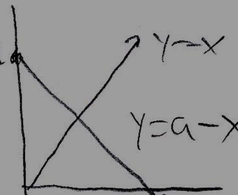
$$\bar{x}=\frac{1}{m}\int_0^\pi\int_1^2 kr^3\cos\theta\,dr\,d\theta = \frac{k}{m}\int_0^\pi\cos\theta\int_1^2 r^3\,dr = 0\int_1^2 r^3\,dr = 0$$

$$\bar{y}=\frac{1}{m}\int_0^\pi\int_1^2 kr^3\sin\theta\,dr\,d\theta = \frac{k}{m}\int_0^\pi\sin\theta\int_1^2 r^3\,dr = \frac{2k}{m}\int_1^2 r^3\,dr$$

$$=\frac{2k}{m}\left[4-\frac{1}{4}\right]=\frac{k}{m}\left(8-\frac{1}{2}\right)=\frac{k}{m}\left(\frac{15}{2}\right)=\frac{3}{7\pi}\left(\frac{15}{2}\right)=\frac{45}{14\pi}$$

$$\boxed{\left(0,\frac{45}{14\pi}\right)}$$

(15)



Since density has symetry on $y=x$, $\bar{x}=\bar{y}$ as all points on line $y=x$ equal eachother,

$\rho=k(x^2+y^2)$ $\quad\boxed{\left(\frac{2a}{5},\frac{2a}{5}\right)}$

$D=\{(x,y)\mid x\in[0,a]\wedge y\in[0,a-x]\}$

$$m=\int_0^a\int_0^{a-x}k(x^2+y^2)\,dy\,dx \quad k\int_0^a\left[x^2y+\frac{y^3}{3}\right]_0^{a-x}dx = k\int_0^a x^2(a-x)+\frac{(a-x)^3}{3}\,dx$$

$$=k\int_0^a -\frac{4x^3}{3}+2ax^2-a^2x+\frac{a^3}{3}\,dx = k\left(-\frac{x^4}{3}+\frac{2ax^3}{3}-\frac{a^2x^2}{2}+\frac{a^3x}{3}\right)\Big|_0^a$$

$$=k\left(-\frac{a^4}{3}+\frac{2a^4}{3}+\frac{a^4}{3}-\frac{a^4}{2}\right)=\frac{ka^4}{6}$$

$$\bar{x}=\frac{1}{m}\int_0^a\int_0^{a-x}kx(x^2+y^2)\,dy\,dx=\frac{k}{m}\int_0^a\left[x^3y+\frac{xy^3}{3}\right]_0^{a-x}dx=\frac{k}{m}\int_0^a x^3(a-x)+\frac{x(a-x)^3}{3}\,dx$$

$$=\frac{k}{m}\int_0^a -\frac{4x^4}{3}+2ax^3-a^2x^2+\frac{a^3x}{3}\,dx=\frac{k}{m}\left(-\frac{4x^5}{15}+\frac{ax^4}{2}-\frac{a^2x^3}{3}+\frac{a^3x^2}{6}\right)\Big|_0^a=\frac{a^5}{15}\left(\frac{k}{m}\right)=\frac{2a}{5}$$