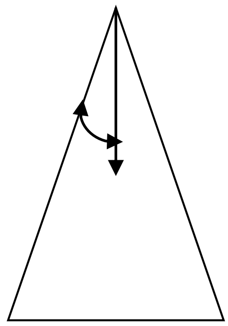
中心 **B** 半径 r

球：$(\mathbf{P}-\mathbf{B})\cdot(\mathbf{P}-\mathbf{B})-r^2=0$



軸ベクトル **W**

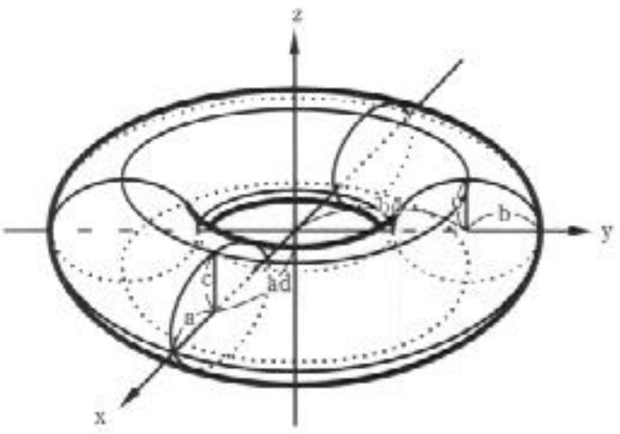
円柱：$(\mathbf{P}-\mathbf{B})\cdot(\mathbf{P}-\mathbf{B})-((\mathbf{P}-\mathbf{B})\cdot\mathbf{W})^2-r^2=0$

円錐：$((\mathbf{P}-\mathbf{B})\cdot\mathbf{W})^2-\cos^2\alpha(\mathbf{P}-\mathbf{B})\cdot(\mathbf{P}-\mathbf{B})=0$

http://en.wikipedia.org/wiki/Cone_(geometry)

$$S(u)=(u\cdot d)^2-(d\cdot d)(u\cdot u)(\cos\theta)^2$$

$$\left(\sqrt{\frac{x^2}{a^2}+\frac{y^2}{b^2}}-d\right)^2+\frac{z^2}{c^2}-1=0,\quad a,b,c>0$$



◆図4.66　標準座標系のトーラス面

$$(x^2+y^2+z^2+R^2-r^2)^2=4R^2(x^2+y^2).$$

$$x^2+y^2+z^2+R^2-r^2-4R^2(x^2+y^2)=0$$

$$(P-B)(P-B)+R^2-r^2-4R^2(x^2+y^2)=0$$

#%

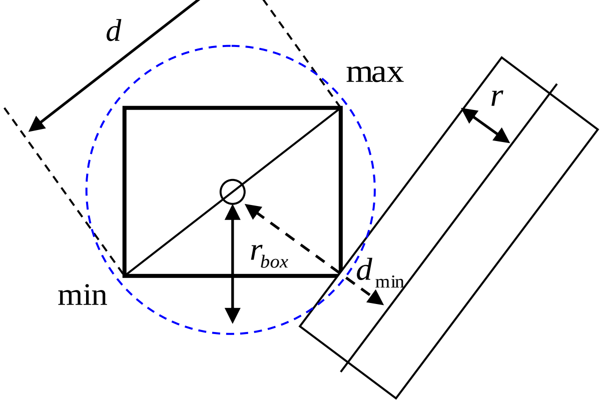
Z=[1,0,0];

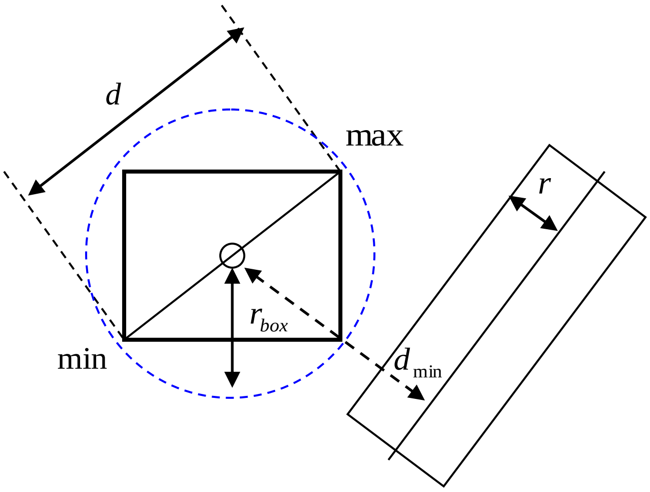
```
Y=[0,1,0];
X=[0,0,1];

extern X;
extern Y;
extern Z;

M=4 4([1,0,0,0],[0,1,0,0],[0,0,1,0],[0,0,0,1]);
Mi=4 4([1,0,0,0],[0,1,0,0],[0,0,1,0],[0,0,0,1]);
Mx = 4 1([1],[1],[1],[1]);

extern M;
extern Mi;
extern Mx;

extern xx;
extern yy;
extern zz;

rotmat2(M,[1,1,1], d2r(45));
sub func(n,xyz)
{
   #local2wld(X,Y,Z,M,Mi);

   Mx{0} = xyz[0];
   Mx{1} = xyz[1];
   Mx{2} = xyz[2];
   My = M*Mx;
   xx = My{0};
   yy = My{1};
   zz = My{2};

   func.ret = 1;

   return (xx);
}
```

```
#expr = "(sqrt(x^2/3+y^2/3)-5)^2+z^2/3-1";
#implicitsurface2(getstr(expr), [-15,-15,-15],[15,15,15],[0.0, 0.0, 0.0], 1);

put 1;
modalcolor(255,100,0);
expr = "u[0]=x;u[1]=y;u[2]=z;$func(3,u[]);x=xx;y=yy;z=zz;(x^2+y^2+z^2+5^2-3)^2-4*5^2*(x^2+y^2)";

implicitsurface2(getstr(expr), [-15,-15,-15],[15,15,15],[0.0, 0.0, 0.0], 1);

end;
```

$$d^2 = (\max.x - \min.x)^2 + (\max.y - \min.y)^2 + (\max.z - \min.z)^2$$

$$r_{box}{}^2 = \frac{d^2}{2}$$





$$r_{box} + r > d_{\min}$$

$$r_{box} + r < d_{\min}$$

$$(r_{box} + r)^2 > d_{\min}{}^2$$

$$r_{box}{}^2 + 2r_{box}r + r^2 > d_{\min}{}^2$$

$$r_{box}{}^2 + 2r_{box}r + r^2 > r_{box}{}^2 + r^2$$

$$r_{box}{}^2 + r^2 > d_{\min}{}^2$$

$$r_{box}{}^2 + r^2 + 2r_{box}r < d_{\min}{}^2$$

$$r_{box}{}^2 + r^2 + 2r_{box}r < d_{\min}{}^2$$

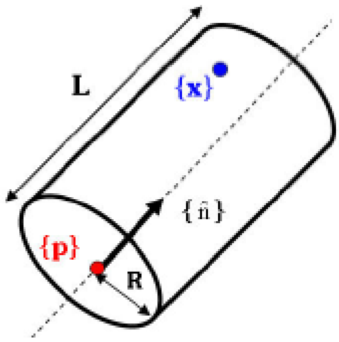
球

$$f(x,y,z)=(x-p_x)^2+(y-p_y)^2+(z-p_z)^2-R^2$$

$$f(x,y,z)=\left(\begin{pmatrix}x & y & z\end{pmatrix}-\begin{pmatrix}p_x & p_y & p_z\end{pmatrix}\right)\left(\begin{pmatrix}x\\y\\z\end{pmatrix}-\begin{pmatrix}p_x\\p_y\\p_z\end{pmatrix}\right)-R^2$$

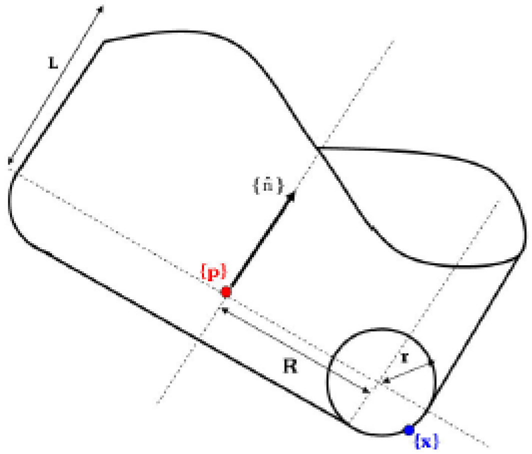
$$\begin{pmatrix}x\\y\\z\end{pmatrix}-\begin{pmatrix}p_x\\p_y\\p_z\end{pmatrix}=\begin{pmatrix}x-p_x\\y-p_y\\z-p_z\end{pmatrix}$$

$$f(x,y,z)=\begin{pmatrix}x-p_x\\y-p_y\\z-p_z\end{pmatrix}^T\begin{pmatrix}x-p_x\\y-p_y\\z-p_z\end{pmatrix}-R^2$$



$$f(x,y,z)=-\left(\begin{pmatrix}x & y & z\end{pmatrix}-\begin{pmatrix}p_x & p_y & p_z\end{pmatrix}\right)\begin{pmatrix}n_x{}^2-1 & n_xn_y & n_xn_z\\ n_xn_y & n_y{}^2-1 & n_yn_y\\ n_xn_z & n_yn_z & n_z{}^2-1\end{pmatrix}\left(\begin{pmatrix}x\\y\\z\end{pmatrix}-\begin{pmatrix}p_x\\p_y\\p_z\end{pmatrix}\right)-R^2$$

$$f(x,y,z)=-\begin{pmatrix}x-p_x\\y-p_y\\z-p_z\end{pmatrix}^T\begin{pmatrix}n_x{}^2-1 & n_xn_y & n_xn_z\\ n_xn_y & n_y{}^2-1 & n_yn_y\\ n_xn_z & n_yn_z & n_z{}^2-1\end{pmatrix}\begin{pmatrix}x-p_x\\y-p_y\\z-p_z\end{pmatrix}-R^2$$



$$f(x,y,z)=\left(\begin{array}{l}-\left(\begin{pmatrix}x & y & z\end{pmatrix}-\begin{pmatrix}p_x & p_y & p_z\end{pmatrix}\right)\begin{pmatrix}n_x{}^2-1 & n_xn_y & n_xn_z\\ n_xn_y & n_y{}^2-1 & n_yn_y\\ n_xn_z & n_yn_z & n_z{}^2-1\end{pmatrix}\left(\begin{pmatrix}x\\ y\\ z\end{pmatrix}-\begin{pmatrix}p_x\\ p_y\\ p_z\end{pmatrix}\right)\\ +\left(\begin{pmatrix}n_x & n_y & n_z\end{pmatrix}\left(\begin{pmatrix}x\\ y\\ z\end{pmatrix}-\begin{pmatrix}p_x\\ p_y\\ p_z\end{pmatrix}\right)\right)^T\begin{pmatrix}n_x & n_y & n_z\end{pmatrix}\left(\begin{pmatrix}x\\ y\\ z\end{pmatrix}-\begin{pmatrix}p_x\\ p_y\\ p_z\end{pmatrix}\right)\end{array}\right)^2$$

$$-4R^2\left(\begin{pmatrix}x & y & z\end{pmatrix}-\begin{pmatrix}p_x & p_y & p_z\end{pmatrix}\right)\begin{pmatrix}n_x{}^2-1 & n_xn_y & n_xn_z\\ n_xn_y & n_y{}^2-1 & n_yn_y\\ n_xn_z & n_yn_z & n_z{}^2-1\end{pmatrix}\left(\begin{pmatrix}x\\ y\\ z\end{pmatrix}-\begin{pmatrix}p_x\\ p_y\\ p_z\end{pmatrix}\right)$$

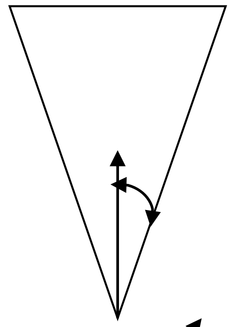
$$f(x,y,z)=\left(\begin{array}{l}-\begin{pmatrix}x-p_x\\ y-p_y\\ z-p_z\end{pmatrix}^T\begin{pmatrix}n_x{}^2-1 & n_xn_y & n_xn_z\\ n_xn_y & n_y{}^2-1 & n_yn_y\\ n_xn_z & n_yn_z & n_z{}^2-1\end{pmatrix}\begin{pmatrix}x-p_x\\ y-p_y\\ z-p_z\end{pmatrix}\\ +\left(\begin{pmatrix}n_x & n_y & n_z\end{pmatrix}\begin{pmatrix}x-p_x\\ y-p_y\\ z-p_z\end{pmatrix}\right)^T\begin{pmatrix}n_x & n_y & n_z\end{pmatrix}\begin{pmatrix}x-p_x\\ y-p_y\\ z-p_z\end{pmatrix}\end{array}\right)^2$$

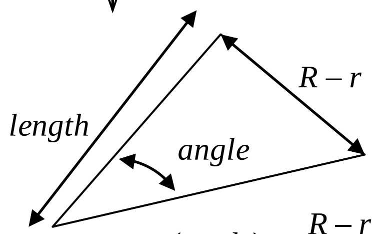
$$-4R^2\begin{pmatrix}x-p_x\\ y-p_y\\ z-p_z\end{pmatrix}^T\begin{pmatrix}n_x{}^2-1 & n_xn_y & n_xn_z\\ n_xn_y & n_y{}^2-1 & n_yn_y\\ n_xn_z & n_yn_z & n_z{}^2-1\end{pmatrix}\begin{pmatrix}x-p_x\\ y-p_y\\ z-p_z\end{pmatrix}$$

円錐

$$((\mathbf{P}-\mathbf{B})\cdot\mathbf{W})^2-\cos^2\alpha(\mathbf{P}-\mathbf{B})\cdot(\mathbf{P}-\mathbf{B})=0$$

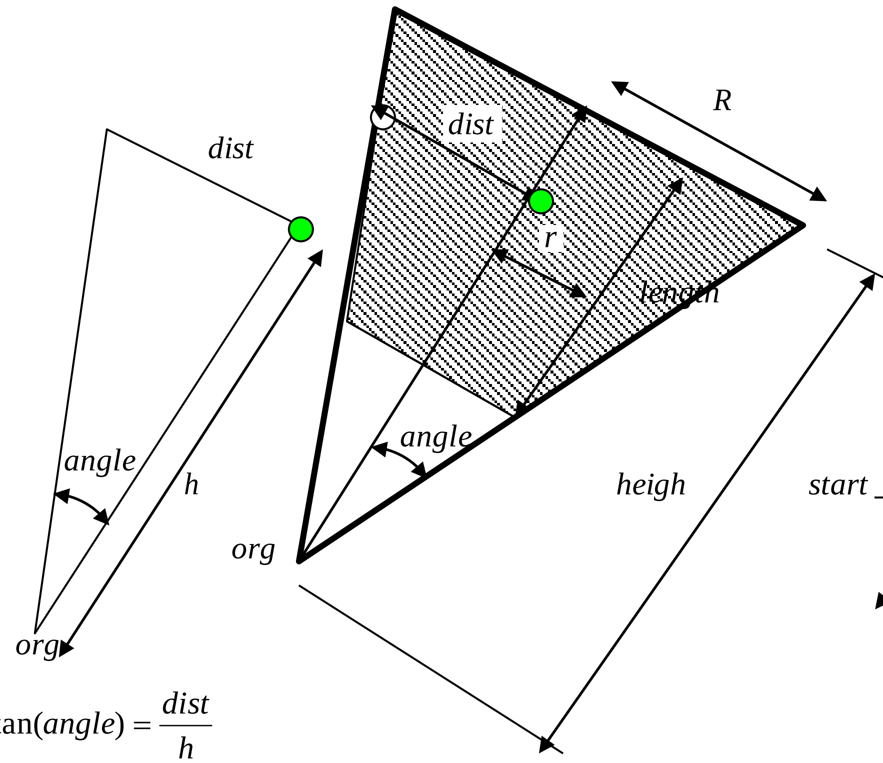
$$f(x,y,z)=-\left(\begin{pmatrix}x-p_x\\y-p_y\\z-p_z\end{pmatrix}^T\begin{pmatrix}n_x\\n_y\\n_z\end{pmatrix}\right)^2+\cos^2(\alpha)\begin{pmatrix}x-p_x\\y-p_y\\z-p_z\end{pmatrix}^T\begin{pmatrix}x-p_x\\y-p_y\\z-p_z\end{pmatrix}$$





$$\tan(angle)=\frac{R-r}{length}$$

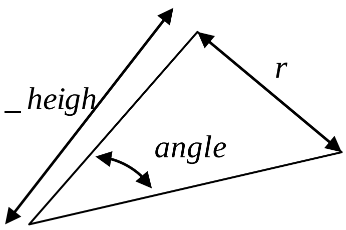
$$angle=\tan^{-1}\left(\frac{R-r}{length}\right)$$



$$\tan(angle)=\frac{dist}{h}$$

$$dist=h\tan(angle)$$

$$dist^2=h^2\tan^2(angle)$$



$$\tan(angle)=\frac{r}{start\_heigh}$$

$$\frac{1}{\tan(angle)}=\frac{start\_heigh}{r}$$

$$start\_heigh=\frac{r}{\tan(angle)}$$