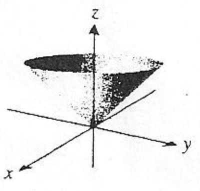
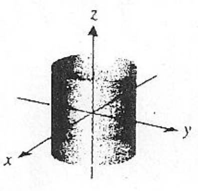
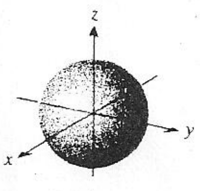
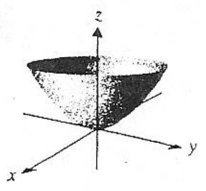
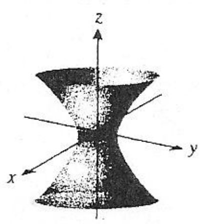
Table 12.7.2

EQUATION	CHARACTERISTIC	CLASSIFICATION
$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$	No minus signs	Ellipsoid
$\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = 1$	One minus sign	Hyperboloid of one sheet
$\frac{z^2}{c^2} - \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$	Two minus signs	Hyperboloid of two sheets
$z^2 - \frac{x^2}{a^2} - \frac{y^2}{b^2} = 0$	No linear terms	Elliptic cone
$z - \frac{x^2}{a^2} - \frac{y^2}{b^2} = 0$	One linear term; two quadratic terms with the same sign	Elliptic paraboloid
$z - \frac{y^2}{b^2} + \frac{x^2}{a^2} = 0$	One linear term; two quadratic terms with opposite signs	Hyperbolic paraboloid

Table 12.8.1

CONVERSION		FORMULAS	RESTRICTIONS
Cylindrical to rectangular Rectangular to cylindrical	$(r, \theta, z) \to (x, y, z)$ $(x, y, z) \to (r, \theta, z)$	$x = r\cos\theta,\quad y = r\sin\theta,\quad z = z$ $r = \sqrt{x^2+y^2},\quad \tan\theta = y/x,\quad z = z$	$r \geq 0, \rho \geq 0$ $0 \leq \theta < 2\pi$ $0 \leq \phi \leq \pi$
Spherical to cylindrical Cylindrical to spherical	$(\rho, \theta, \phi) \to (r, \theta, z)$ $(r, \theta, z) \to (\rho, \theta, \phi)$	$r = \rho\sin\phi,\quad \theta = \theta,\quad z = \rho\cos\phi$ $\rho = \sqrt{r^2+z^2},\quad \theta = \theta,\quad \tan\phi = r/z$	
Spherical to rectangular Rectangular to spherical	$(\rho, \theta, \phi) \to (x, y, z)$ $(x, y, z) \to (\rho, \theta, \phi)$	$x = \rho\sin\phi\cos\theta,\quad y = \rho\sin\phi\sin\theta,\quad z = \rho\cos\phi$ $\rho = \sqrt{x^2+y^2+z^2},\quad \tan\theta = y/x,\quad \cos\phi = z/\sqrt{x^2+y^2+z^2}$	

Table 12.8.2

	CONE	CYLINDER	SPHERE	PARABOLOID	HYPERBOLOID
					
RECTANGULAR	$z = \sqrt{x^2+y^2}$	$x^2 + y^2 = 1$	$x^2 + y^2 + z^2 = 1$	$z = x^2 + y^2$	$x^2 + y^2 - z^2 = 1$
CYLINDRICAL	$z = r$	$r = 1$	$z^2 = 1 - r^2$	$z = r^2$	$z^2 = r^2 - 1$
SPHERICAL	$\phi = \pi/4$	$\rho = \csc\phi$	$\rho = 1$	$\rho = \cos\phi\csc^2\phi$	$\rho^2 = -\sec 2\phi$