

Surface	Standard Equation	Typical Cross-Sections	Features
Ellipsoid	$x^2/a^2 + y^2/b^2 + z^2/c^2 = 1$	$z=k$: ellipse $x=k, y=k$: ellipse	Closed; intercepts $\pm a, \pm b, \pm c$
Hyperboloid (1 sheet)	$x^2/a^2 + y^2/b^2 - z^2/c^2 = 1$	$z=k$: ellipse $x=k, y=k$: hyperbola	Connected hourglass; doubly ruled
Hyperboloid (2 sheets)	$-x^2/a^2 - y^2/b^2 + z^2/c^2 = 1$	$z=k$ ($ k > c$): ellipse $x=k, y=k$: hyperbola	Two disjoint caps
Elliptic Cone	$x^2/a^2 + y^2/b^2 - z^2/c^2 = 0$	$z=k \neq 0$: ellipse $x=k, y=k$: intersecting lines	Vertex at origin; ruled
Elliptic Paraboloid	$z = x^2/a^2 + y^2/b^2$	$z=k$: ellipse $x=k, y=k$: parabola	Bowl-shaped; opens $\pm z$
Hyperbolic Paraboloid	$z = x^2/a^2 - y^2/b^2$	$z=k$: hyperbola $x=k, y=k$: parabola	Saddle; doubly ruled
Parabolic Cylinder	$y = x^2/a^2$	plane \parallel x-y: same parabola	Extends along z
Elliptic Cylinder	$x^2/a^2 + y^2/b^2 = 1$	plane \parallel x-y: same ellipse	Cylindrical; zero curvature
Hyperbolic Cylinder	$x^2/a^2 - y^2/b^2 = 1$	plane \parallel x-y: same hyperbola	Two sheets extending in z