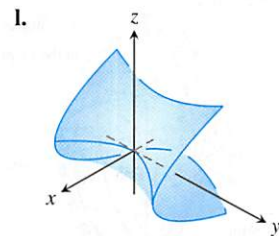
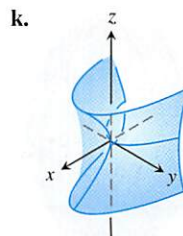
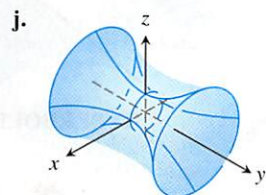
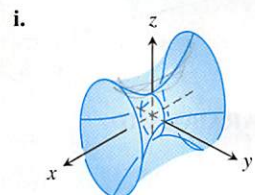
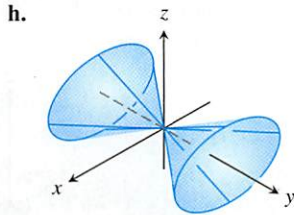
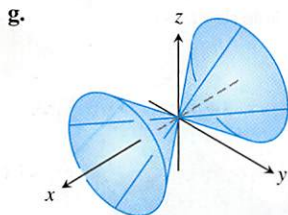
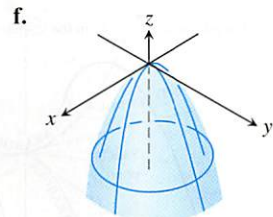
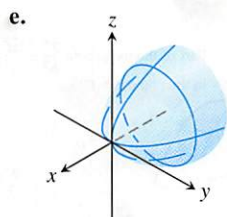
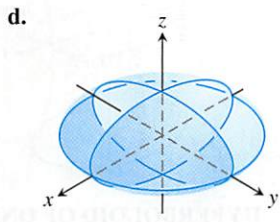
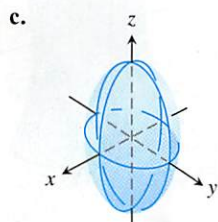
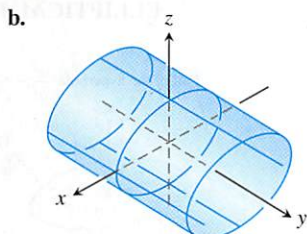
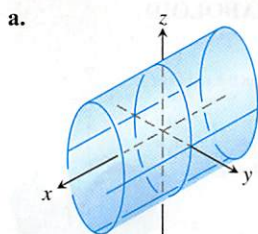


EXERCISES 11.6

In Exercises 1–12, match the equation with the surface it defines. Also, identify each surface by type (paraboloid, ellipsoid, etc.) The surfaces are labeled (a)–(l).

1. $x^2 + y^2 + 4z^2 = 10$
2. $z^2 + 4y^2 - 4x^2 = 4$
3. $9y^2 + z^2 = 16$
4. $y^2 + z^2 = x^2$
5. $x = y^2 - z^2$
6. $x = -y^2 - z^2$
7. $x^2 + 2z^2 = 8$
8. $z^2 + x^2 - y^2 = 1$
9. $x = z^2 - y^2$
10. $z = -4x^2 - y^2$
11. $x^2 + 4z^2 = y^2$
12. $9x^2 + 4y^2 + 2z^2 = 36$



Sketch the surfaces in Exercises 13–44.

CYLINDERS

13. $x^2 + y^2 = 4$
14. $z = y^2 - 1$
15. $x^2 + 4z^2 = 16$
16. $4x^2 + y^2 = 36$

ELLIPSOIDS

17. $9x^2 + y^2 + z^2 = 9$
18. $4x^2 + 4y^2 + z^2 = 16$
19. $4x^2 + 9y^2 + 4z^2 = 36$
20. $9x^2 + 4y^2 + 36z^2 = 36$

PARABOLOIDS AND CONES

21. $z = x^2 + 4y^2$
22. $z = 8 - x^2 - y^2$
23. $x = 4 - 4y^2 - z^2$
24. $y = 1 - x^2 - z^2$
25. $x^2 + y^2 = z^2$
26. $4x^2 + 9z^2 = 9y^2$

HYPERBOLOIDS

27. $x^2 + y^2 - z^2 = 1$
28. $y^2 + z^2 - x^2 = 1$
29. $z^2 - x^2 - y^2 = 1$
30. $(y^2/4) - (x^2/4) - z^2 = 1$

HYPERBOLIC PARABOLOIDS

31. $y^2 - x^2 = z$
32. $x^2 - y^2 = z$

ASSORTED

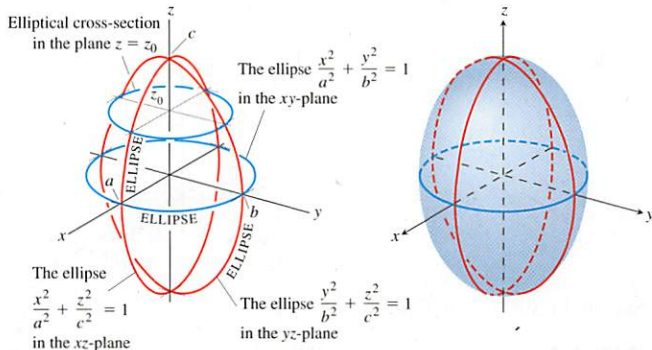
33. $z = 1 + y^2 - x^2$
34. $4x^2 + 4y^2 = z^2$
35. $y = -(x^2 + z^2)$
36. $16x^2 + 4y^2 = 1$
37. $x^2 + y^2 - z^2 = 4$
38. $x^2 + z^2 = y$
39. $x^2 + z^2 = 1$
40. $16y^2 + 9z^2 = 4x^2$
41. $z = -(x^2 + y^2)$
42. $y^2 - x^2 - z^2 = 1$
43. $4y^2 + z^2 - 4x^2 = 4$
44. $x^2 + y^2 = z$
45. a. Express the area A of the cross-section cut from the ellipsoid

$$x^2 + \frac{y^2}{4} + \frac{z^2}{9} = 1$$

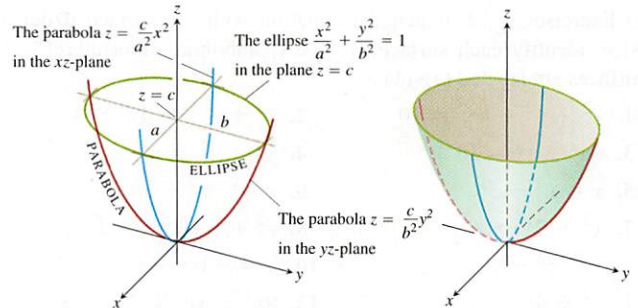
by the plane $z = c$ as a function of c . (The area of an ellipse with semiaxes a and b is πab .)

- b. Use slices perpendicular to the z -axis to find the volume of the ellipsoid in part (a).

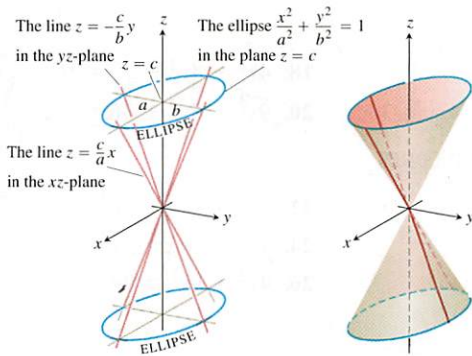
TABLE 11.1 Graphs of Quadric Surfaces



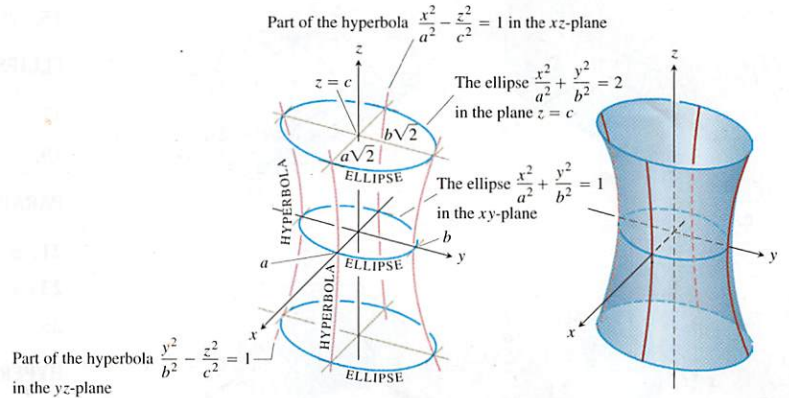
ELLIPTICOID



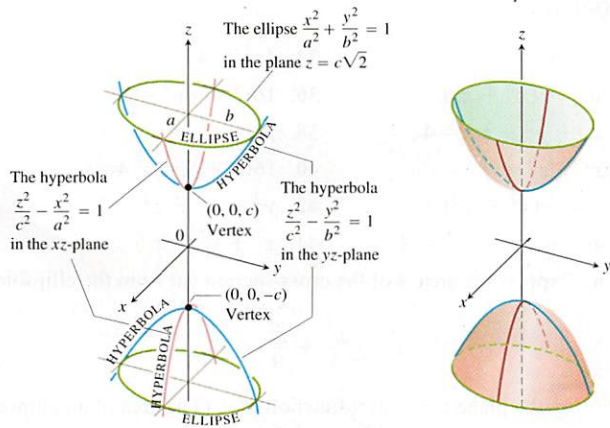
ELLIPTICAL PARABOLOID



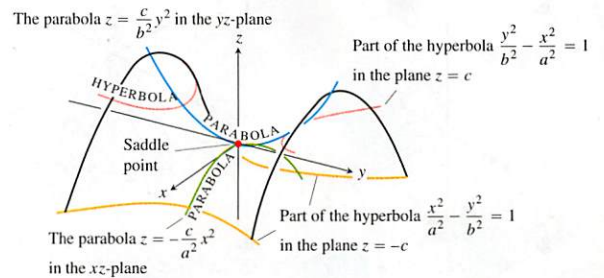
ELLIPTICAL CONE



HYPERBOLOID OF ONE SHEET



HYPERBOLOID OF TWO SHEETS



HYPERBOLIC PARABOLOID