10. (a) Find and identify the traces of the quadric surface 
\[-x^2 - y^2 + z^2 = 1\] and explain why the graph looks like 
the graph of the hyperboloid of two sheets in Table 1.
(b) If the equation in part (a) is changed to \[x^2 - y^2 - z^2 = 1,\] 
what happens to the graph? Sketch the new graph.

11–20 Use traces to sketch and identify the surface.
11. \[x = y^2 + 4z^2\]  
12. \[4x^2 + 9y^2 + 9z^2 = 36\]
13. \[x^2 = 4y^2 + z^2\]  
14. \[z^2 - 4x^2 - y^2 = 4\]
15. \[9y^2 + 4z^2 = x^2 + 36\]  
16. \[3x^2 + y + 3z^2 = 0\]
17. \[\frac{x^2}{9} + \frac{y^2}{25} + \frac{z^2}{4} = 1\]  
18. \[3x^2 - y^2 + 3z^2 = 0\]
19. \[y = z^2 - x^2\]  
20. \[x = y^2 - z^2\]

21–28 Match the equation with its graph (labeled I–VIII). Give 
reasons for your choice.
21. \[x^2 + 4y^2 + 9z^2 = 1\]  
22. \[9x^2 + 4y^2 + z^2 = 1\]
23. \[x^2 - y^2 + z^2 = 1\]  
24. \[-x^2 + y^2 - z^2 = 1\]
25. \[y = 2x^2 + z^2\]  
26. \[y^2 = x^2 + 2z^2\]
27. \[x^2 + 2z^2 = 1\]  
28. \[y = x^2 - z^2\]

29–30 Sketch and identify a quadric surface that could have 
the traces shown.
29. Traces in \(x = k\)  
30. Traces in \(y = k\)

31–38 Reduce the equation to one of the standard forms, classify 
the surface, and sketch it.
31. \[y^2 = x^2 + \frac{1}{2}z^2\]  
32. \[4x^2 - y + 2z^2 = 0\]
33. \[x^2 + 2y - 2z^2 = 0\]  
34. \[y^2 = x^2 + 4z^2 + 4\]
35. \[x^2 + y^2 - 2x - 6y - z + 10 = 0\]  
36. \[x^2 - y^2 - z^2 - 4x - 2z + 3 = 0\]
37. \[x^2 - y^2 + z^2 - 4x - 2z = 0\]  
38. \[4x^2 + y^2 + z^2 - 24x - 8y + 4z + 55 = 0\]

39–42 Use a computer with three-dimensional graphing 
software to graph the surface. Experiment with viewpoints and with 
domains for the variables until you get a good view of the surface.
39. \[-4x^2 - y^2 + z^2 = 1\]  
40. \[x^3 - y^2 - z = 0\]
41. \[-4x^2 - y^2 + z^2 = 0\]  
42. \[x^3 - 6x + 4y^2 - z = 0\]

43. Sketch the region bounded by the surfaces 
\[z = \sqrt{x^2 + y^2}\] 
and \[x^2 + y^2 = 1\] for \(1 \leq z \leq 2.\)
44. Sketch the region bounded by the paraboloids 
\[z = x^2 + y^2\] 
and \[z = 2 - x^2 - y^2.\]
$x^2 + 4y^2 + 9z^2 = 1$

$(\pm 1, 0, 0)$
$(0, \pm \frac{1}{2}, 0)$
$(0, 0, \pm \frac{1}{3})$

$y = 0$ allowed

23. $x^2 - y^2 + z^2 = 1$

$z = k : x^2 - y^2 = 1 - k^2$ \(\text{hyperbolas}\)

$x = k : z^2 - y^2 = 1 - k^2$ \(\text{hyperbolas}\)

$y = k : x^2 + z^2 = 1 + k^2$ \(\text{circle}\)

$y = 0$ not allowed

24. $-x^2 + y^2 - z^2 = 1$

$y = k : y^2 - z^2 = 1 + k^2$ \(\text{hyperbolas}\)

$z = k : y^2 - x^2 = 1 + k^2$ \(\text{hyperbolas}\)

$y = k : x^2 + z^2 = k^2 - 1$ \(\oplus \text{circles}\)$