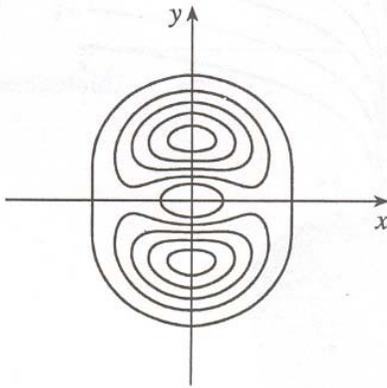


Solutions: HW Section 11.1

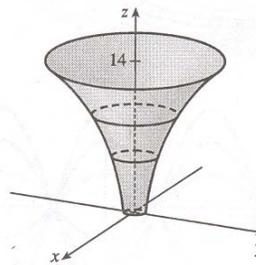
#9, 12, 13, 16, 26, 31-36

9. The point $(-3, 3)$ lies between the level curves with z -values 50 and 60. Since the point is a little closer to the level curve with $z = 60$, we estimate that $f(-3, 3) \approx 56$. The point $(3, -2)$ appears to be just about halfway between the level curves with z -values 30 and 40, so we estimate $f(3, -2) \approx 35$. The graph rises as we approach the origin, gradually from above, steeply from below.

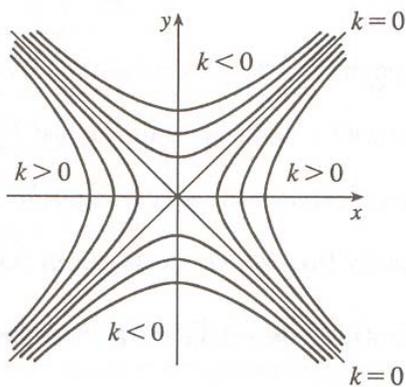
12.



13.

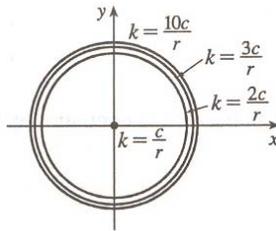


16. The level curves are $k = x^2 - y^2$. When $k = 0$, these are the lines $y = \pm x$. When $k > 0$, the curves are hyperbolas with axis the x -axis and when $k < 0$, they are hyperbolas with axis the y -axis.



26. The equipotential curves are $k = c / \sqrt{r^2 - x^2 - y^2}$ or $x^2 + y^2 = r^2 - (c/k)^2$, a family of circles ($k \geq c/r$).

Note: As $k \rightarrow \infty$, the radius of the circle approaches r .



31. (a) B *Reasons:* This function is constant on any circle centered at the origin, a description which matches only B and III.
 (b) III
32. (a) C *Reasons:* This function is the same if x is interchanged with y , so its graph is symmetric about the plane $x = y$. Also, $z(0, 0) = 0$ and the values of z approach 0 as we use points farther from the origin. These conditions are satisfied only by C and II.
 (b) II
33. (a) F *Reasons:* z increases without bound as we use points closer to the origin, a condition satisfied only by F and V.
 (b) V
34. (a) A *Reasons:* Along the lines $y = \pm \frac{1}{\sqrt{3}}x$ and $x = 0$, this function is 0.
 (b) VI
35. (a) D *Reasons:* This function is periodic in both x and y , with period 2π in each variable.
 (b) IV
36. (a) E *Reasons:* This function is periodic along the x -axis, and increases as $|y|$ increases.
 (b) I