2. (a) From the table, $f(95, 70) = 124$, which means that when the actual temperature is 95 °F and the relative humidity is 70%, the perceived air temperature is approximately 124 °F.

(b) Looking at the row corresponding to $T = 90$, we see that $f(90, h) = 100$ when $h = 60$.

(c) Looking at the column corresponding to $h = 50$, we see that $f(T, 50) = 88$ when $T = 85$.

(d) $I = f(80, h)$ means that T is fixed at 80 and h is allowed to vary, resulting in a function of h that gives the humidex values for different relative humidities when the actual temperature is 80 °F. Similarly, $I = f(100, h)$ is a function of one variable that gives the humidex values for different relative humidities when the actual temperature is 100 °F. Looking at the rows of the table corresponding to $T = 80$ and $T = 100$, we see that $f(80, h)$ increases at a relatively constant rate of approximately 1 °F per 10% relative humidity, while $f(100, h)$ increases more quickly (at first with an average rate of change of 5 °F per 10% relative humidity) and at an increasing rate (approximately 12 °F per 10% relative humidity for larger values of h).

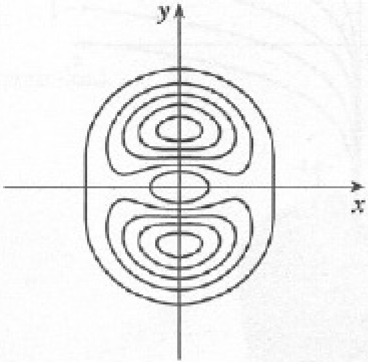
8. (a) $g(2,-2,4) = \ln\left(25 - 2^2 - (-2)^2 - 4^2\right) = \ln 1 = 0.$

(b) For the logarithmic function to be defined, we need $25 - x^2 - y^2 - z^2 > 0$. Thus the domain of g is $\{(x,y,z) \mid x^2 + y^2 + z^2 < 25\}$, the interior of the sphere $x^2 + y^2 + z^2 = 25$.

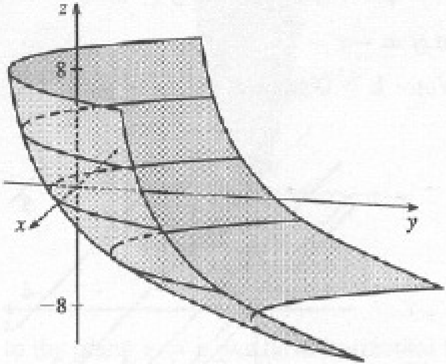
(c) Since $0 < 25 - x^2 - y^2 - z^2 \leq 25$ for (x,y,z) in the domain of g, $\ln\left(25 - x^2 - y^2 - z^2\right) \leq \ln 25$. Thus the range of g is $(-\infty, \ln 25]$.

10. If we start at the origin and move along the x-axis, for example, the z-values of a cone centered at the origin increase at a constant rate, so we would expect its level curves to be equally spaced. A paraboloid with vertex the origin, on the other hand, has z-values which change slowly near the origin and more quickly as we move farther away. Thus, we would expect its level curves near the origin to be spaced more widely apart than those farther from the origin. Therefore contour map I must correspond to the paraboloid, and contour map II the cone.

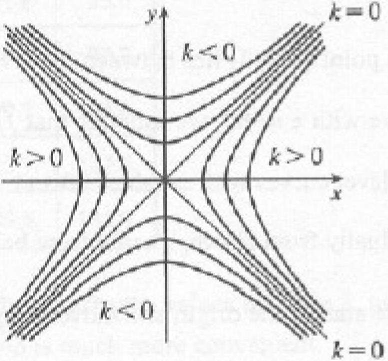
12.



14.

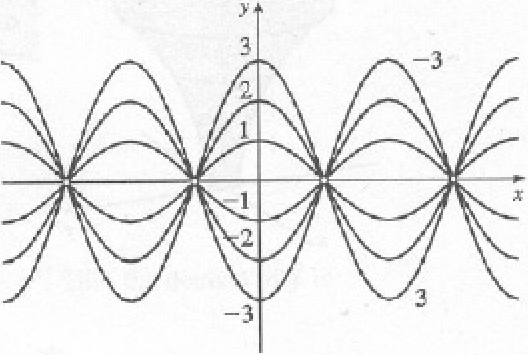


16. The level curves are $k = x^2 - y^2$. When $k = 0$, these are the lines $y = \pm x$. When $k > 0$, the curves are hyperbolas with axis the x-axis and when $k < 0$, they are hyperbolas with axis the y-axis.



20. $k = y \sec x$ or $y = k \cos x$, $x \neq \frac{\pi}{2} + n\pi$

(n an integer)



22. For $k \neq 0$ and $(x, y) \neq (0, 0)$, $k = \dfrac{y}{x^2 + y^2} \Leftrightarrow$

$$x^2 + y^2 - \frac{y}{k} = 0 \quad \Leftrightarrow \quad x^2 + \left(y - \frac{1}{2k}\right)^2 = \frac{1}{4k^2},$$

a family of circles with center $\left(0, \frac{1}{2k}\right)$ and radius $\frac{1}{2k}$ (without the origin). If $k = 0$, the level curve is the x-axis.