2. The *temperature-humidity index* I (or humidex, for short) is the perceived air temperature when the actual temperature is T and the relative humidity is h, so we can write $I = f(T, h)$. The following table of values of I is an excerpt from a table compiled by the National Oceanic and Atmospheric Administration.

TABLE 3 Apparent temperature as a function of temperature and humidity

	Relative humidity (%)					
T \ h	20	30	40	50	60	70
80	77	78	79	81	82	83
85	82	84	86	88	90	93
90	87	90	93	96	100	106
95	93	96	101	107	114	124
100	99	104	110	120	132	144

(Actual temperature (°F))

(a) What is the value of $f(95, 70)$? What is its meaning?
(b) For what value of h is $f(90, h) = 100$?
(c) For what value of T is $f(T, 50) = 88$?
(d) What are the meanings of the functions $I = f(80, h)$ and $I = f(100, h)$? Compare the behavior of these two functions of h.

a) $f(95, 70) = 124$

124° is the apparent temperature

b) $h = 60$

c) $T = 88$

d) $f(80, h)$ considers various % humidity at 80°F

$f(100, h)$ considers various % humidity as well but at 100°F
In $f(80, h)$ as % humidity increases, I increases linearly.
In $f(100, h)$ I increases at a much faster rate.

8. Find and sketch the domain of the function $f(x, y) = \sqrt{1 + x - y^2}$. What is the range of f?

$1 + x - y^2 \geq 0$
$x \geq y^2 - 1$

Domain $\{(x, y) \mid x \geq y^2 - 1\}$
Range $[0, \infty)$

$x \geq y^2 - 1$

$(-1, 0)$
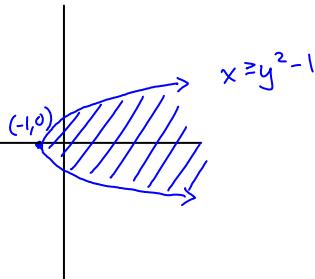
13. $f(x, y) = \ln(9 - x^2 - 9y^2)$ Find and sketch the domain of the function.

$9 - x^2 - 9y^2 > 0$
$-x^2 - 9y^2 > -9$
$x^2 + 9y^2 < 9$
$\dfrac{x^2}{9} + y^2 < 1$
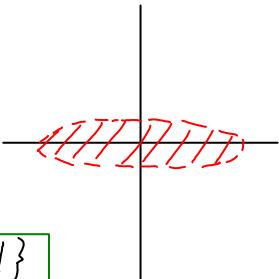
Domain: $\left\{(x, y) \mid \dfrac{x^2}{9} + y^2 < 1\right\}$

**26.** $f(x, y) = 3 - x^2 - y^2$ Sketch the graph of the function

$3 - x^2 - y^2 = z$
$f(0,0) = \quad z = 3$
consider $f(0, y)$ $3 - y^2 = z$
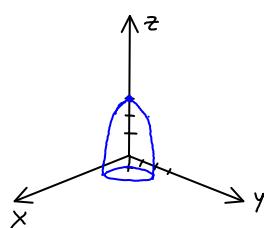
30. Match the function with its graph (labeled I–VI). Give reasons for your choices.

(a) $f(x, y) = |x| + |y|$
(b) $f(x, y) = |xy|$
(c) $f(x, y) = \dfrac{1}{1 + x^2 + y^2}$
(d) $f(x, y) = (x^2 - y^2)^2$
(e) $f(x, y) = (x - y)^2$
(f) $f(x, y) = \sin(|x| + |y|)$

I

II

III

IV

V

VI
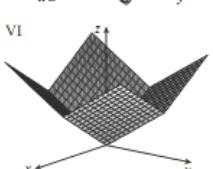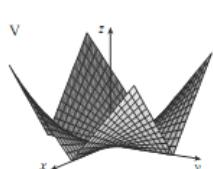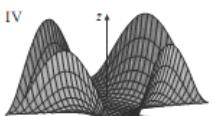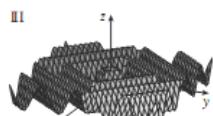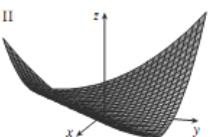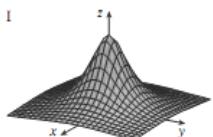
a) Answer: IV; Choices V and VI are obvious to first observe due to their pointy nature at the origin. When y=0, z=|x| shows in the graph so it must be VI.

b) Answer: V; When either y=0 or x=0 then z will always = 0. The graph V shows distinct lining up with the x and y axis.

c) Answer: I; As x and y are deviate from 0, since they are in the denominator, they make z smaller the further away from the origin.

d) Answer: IV; The equation should be foiled out:

$$x^4 - 2x^2y^2 + y^4$$

In graph IV there are 4 distinct parabolas just like in the foiled out equation.

e) Answer: II; It is the only parabola left

f) Answer III; The sin function has the oscillating maze like structure with the ends being "sharpened" by the absolute value portion.

32. Two contour maps are shown. One is for a function f whose graph is a cone. The other is for a function g whose graph is a paraboloid. Which is which, and why?

I

II
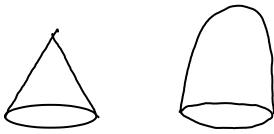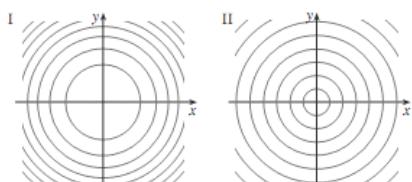
If we consider equal values of k, then the cone with have level curves that are equidistant from each other. Therefore II is the cone, which is further enforced by the fact that the tip is smaller than I. The paraboliod is I because the tip is larger and the distance between each level curve decreases as we go down the paraboliod.

40. $f(x, y) = e^{y/x}$ Draw a contour map showing several level curves.

$$k = 1, 2, 3, 4$$

$$e^{\frac{y}{x}} = k$$

$$y = x \ln k$$

$$y = x \ln(1)$$
$$y = 0$$
$$y = x \ln 4 =$$

$$y = x \ln 2 = .69x$$
$$y = x \ln 3 \approx 1.09$$

$k = 1$

$\ln k$ is slope