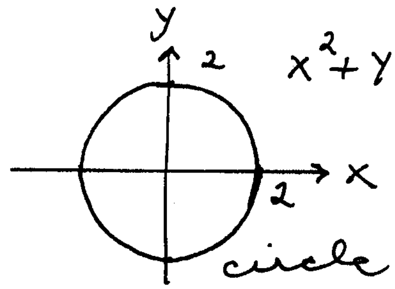
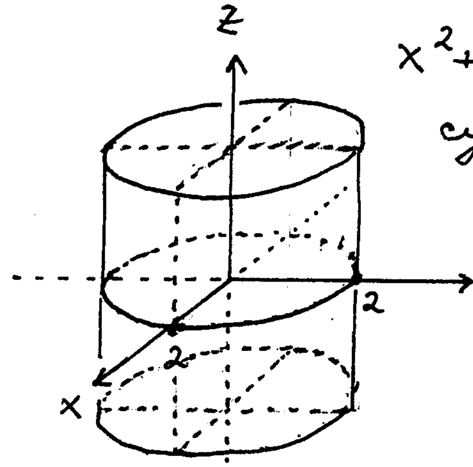
Section 12.6

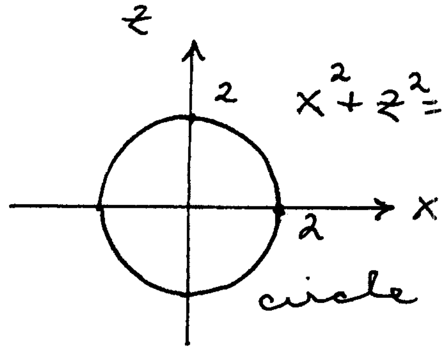
13.) $x^2+y^2=4$



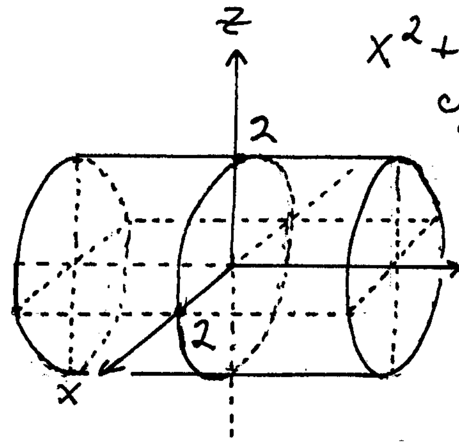
$x^2+y^2=4$ cylinder



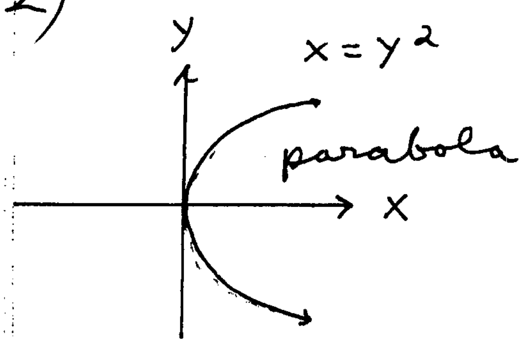
Ex 1) $x^2+z^2=4$



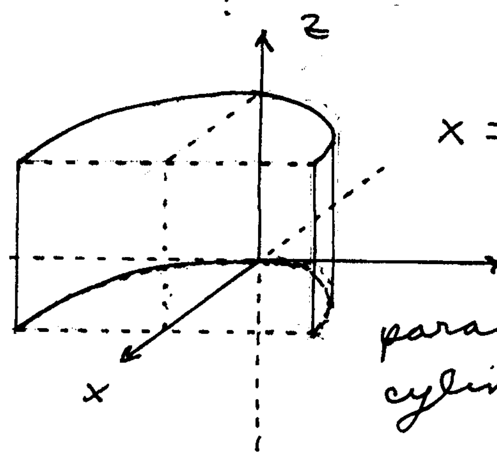
$x^2+z^2=4$ cylinder



Ex 2) $x=y^2$



$x=y^2$



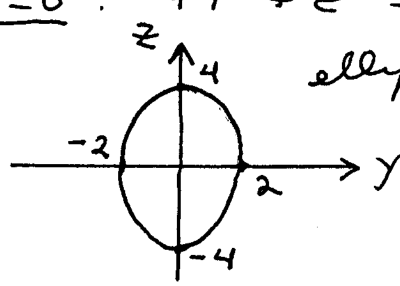
parabolic cylinder

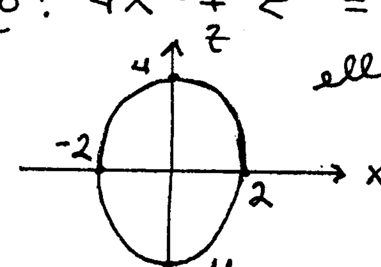
18) $4x^2+4y^2+z^2=16$: Intercepts:

$x=0,\ y=0 \rightarrow z=\pm 4$; $x=0,\ z=0 \rightarrow y=\pm 2$;

$y=0,\ z=0 \rightarrow x=\pm 2$; Traces :

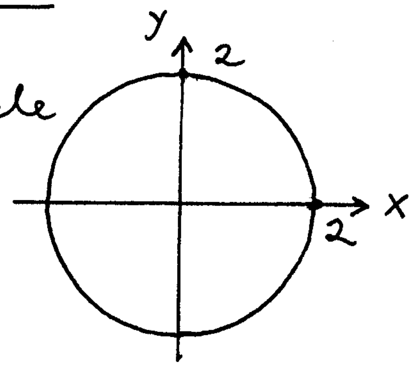
$\underline{x=0}$: $4y^2+z^2=16$; $\underline{y=0}$: $4x^2+z^2=16$





$\underline{z=0}$: $x^2+y^2=4$

circle



Level Curves

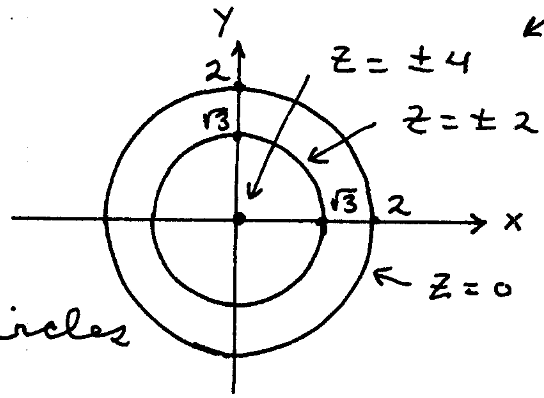
$z=-4$: $x^2+y^2=0 \rightarrow x=0, y=0$

$z=-2$: $x^2+y^2=3$

$z=0$: $x^2+y^2=4$

$z=2$: $x^2+y^2=3$

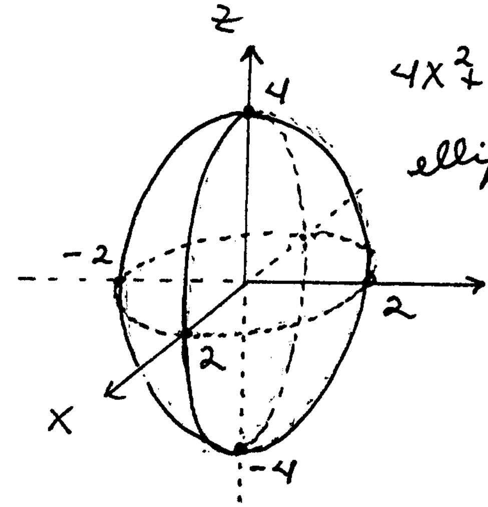
$z=4$: $x^2+y^2=0 \rightarrow x=0, y=0$



circles

$4x^2+4y^2+z^2=16$

ellipsoid



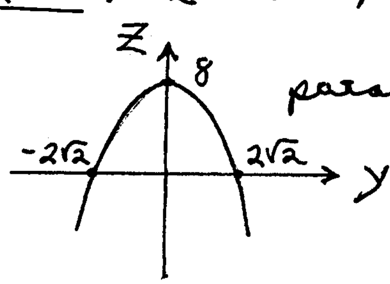
22) $z=8-x^2-y^2$: Intercepts :

$x=0, y=0 \rightarrow z=8$; $x=0, z=0 \rightarrow y=\pm 2\sqrt{2}$;

$y=0, z=0 \rightarrow x=\pm 2\sqrt{2}$; Traces :

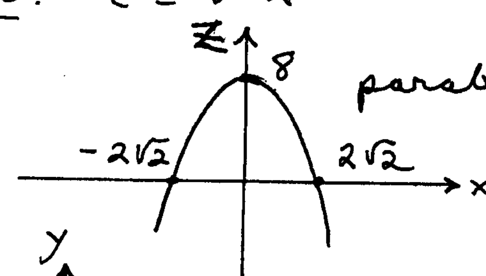
$\underline{x=0}$: $z=8-y^2$

parabola



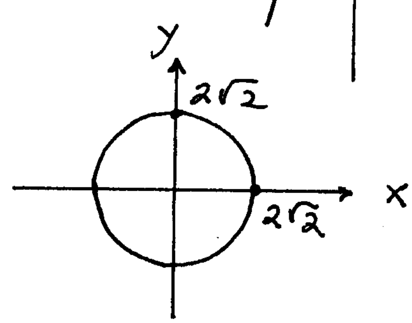
$\underline{y=0}$: $z=8-x^2$

parabola



$\underline{z=0}$: $x^2+y^2=8$

circle



Level Curves

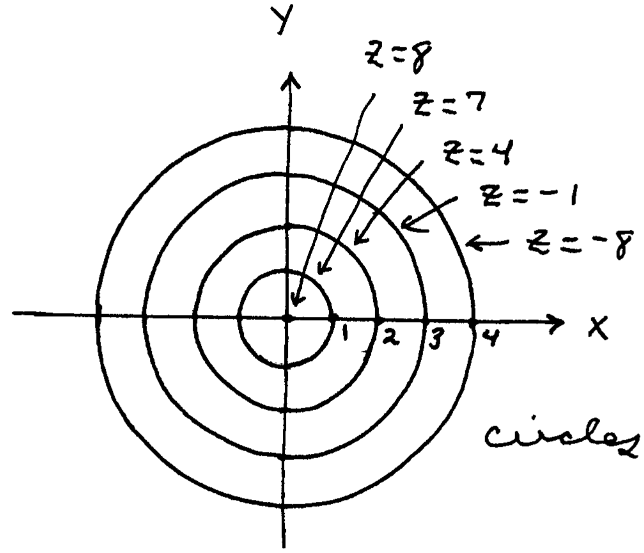
$z=8: x^2+y^2=0 \longrightarrow x=0, y=0$

$z=7: x^2+y^2=1$

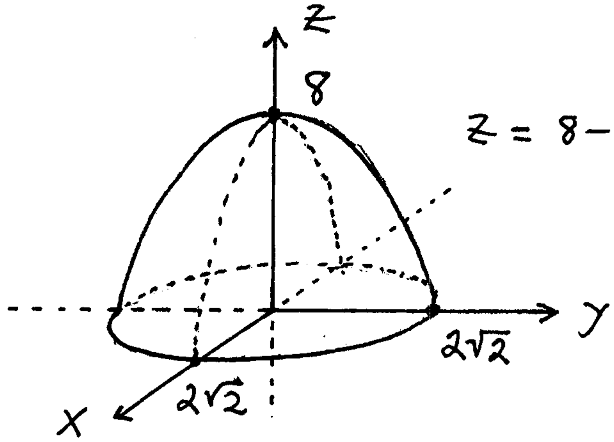
$z=4: x^2+y^2=4$

$z=-1: x^2+y^2=9$

$z=-8: x^2+y^2=16$



circles



$z = 8 - x^2 - y^2$

paraboloid

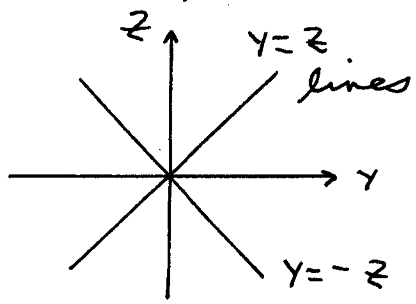
25) $x^2+y^2=z^2$: **Intercepts:**

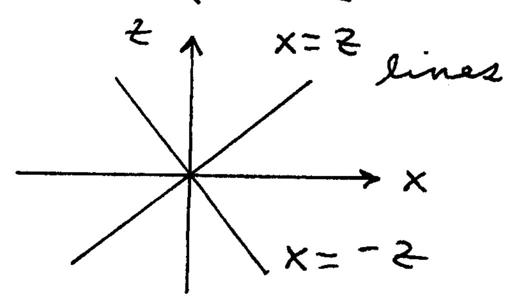
$x=0, y=0 \longrightarrow z=0$; $x=0, z=0 \longrightarrow y=0$;

$y=0, z=0 \longrightarrow x=0$; **Traces:**

$\underline{x=0}: \; y^2=z^2 \longrightarrow y=\pm z$

$\underline{y=0}: \; x^2=z^2 \longrightarrow x=\pm z$

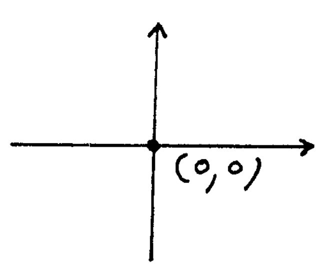




$\underline{z=0}: \; x^2+y^2=0$

$\longrightarrow x=0, y=0$

point



Level Curves

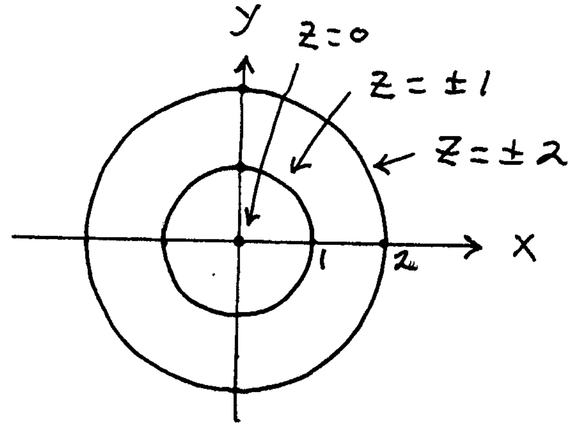
$z=-2: \quad x^2+y^2=4$

$z=-1: \quad x^2+y^2=1$

$z=0: \quad x^2+y^2=0 \rightarrow x=0, y=0$

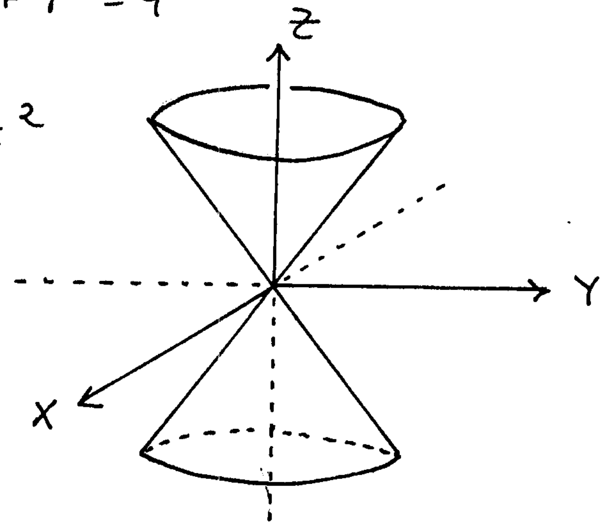
$z=1: \quad x^2+y^2=1$

$z=2: \quad x^2+y^2=4$



$x^2+y^2=z^2$

two cones

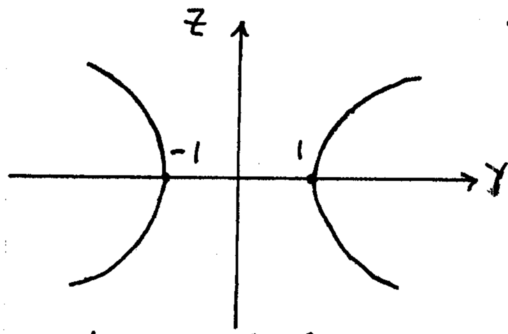


27) $x^2+y^2=z^2+1$: Intercepts :

$x=0, y=0 \rightarrow z^2+1=0$ (impossible !) ;

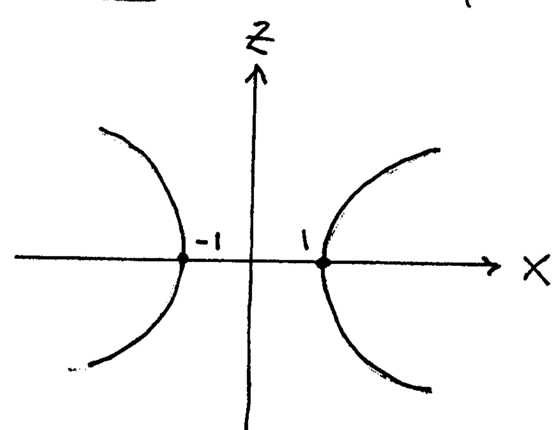
$x=0, z=0 \rightarrow y=\pm 1$; $y=0, z=0 \rightarrow x=\pm 1$;

Traces : $x=0$: $y^2-z^2=1$



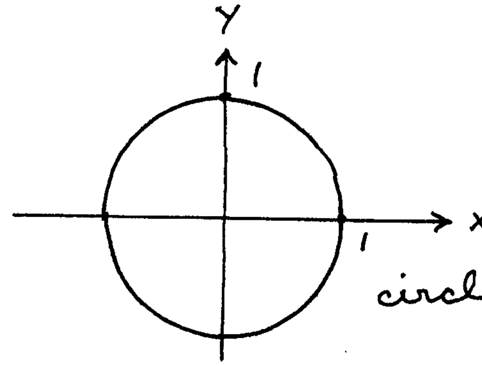
hyperbola

$y=0$: $x^2-z^2=1$



hyperbola

$\underline{z=0}$: $x^2+y^2=1$



circle

<u>Level Curves</u> :

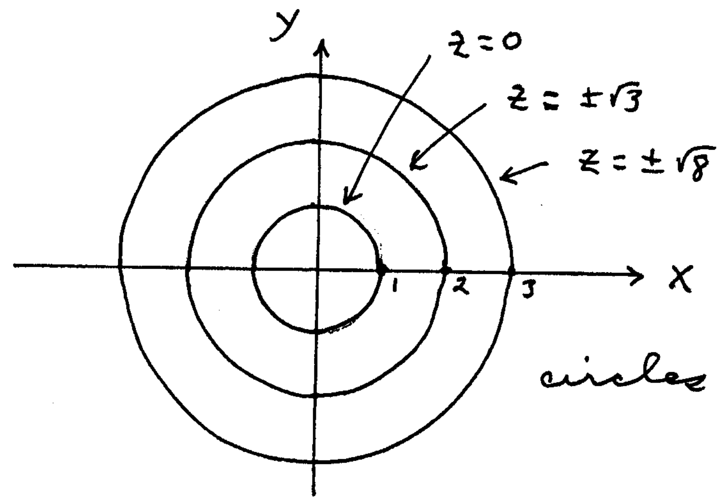
$z=-\sqrt{8}$: $x^2+y^2=9$

$z=-\sqrt{3}$: $x^2+y^2=4$

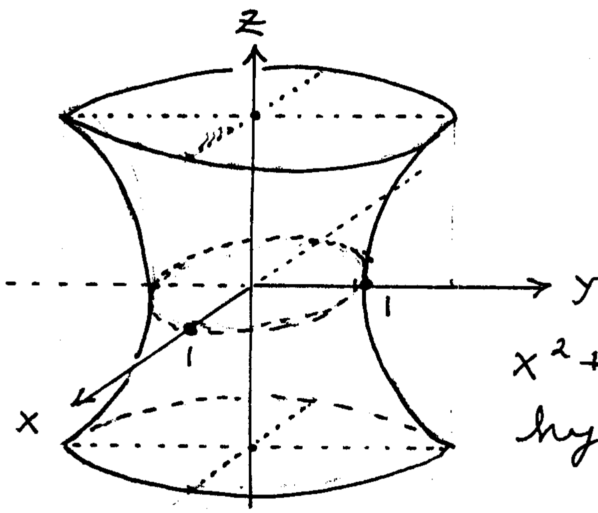
$z=0$: $x^2+y^2=1$

$z=\sqrt{3}$: $x^2+y^2=4$

$z=\sqrt{8}$: $x^2+y^2=9$



circles



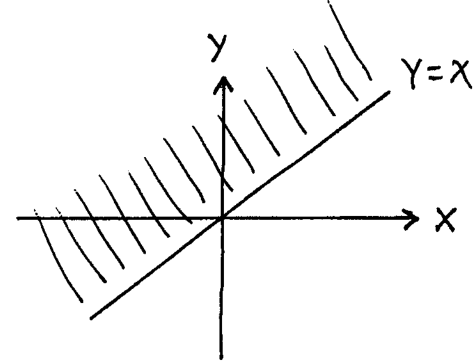
$x^2+y^2=z^2+1$

hyperboloid
of one sheet

Section 14.1

18) $f(x,y) = \sqrt{y-x}$

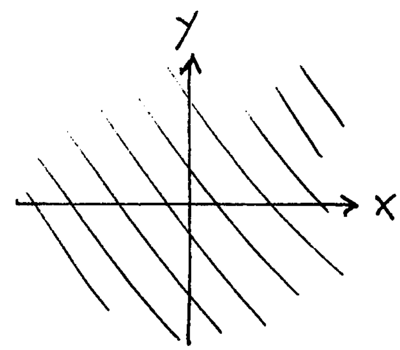
a.) Domain : $y - x \geq 0$.
so all pts. (x,y) with
$y \geq x$



b.) Consider all pts. $(0,y)$ for $0 \leq y < \infty$;
for these pts. the z-value is
$z = \sqrt{y}$ and $0 \leq z < \infty$. It follows
(since $\sqrt{x-y} \geq 0$) that the Range of f
is $0 \leq z < \infty$.

19) $f(x,y) = 4x^2 + 9y^2$

a.) Domain :
all pts. (x,y)

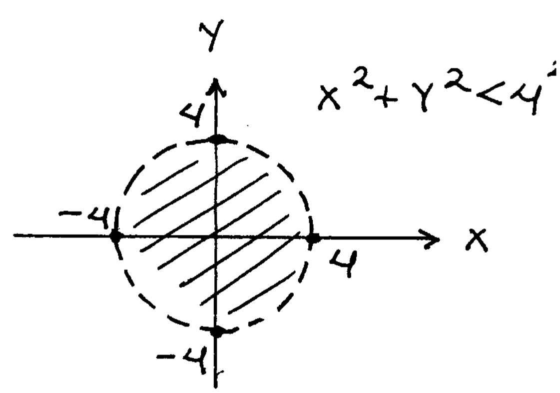


b.) Consider all pts.
$(x,0)$ for $-\infty < x < \infty$; for these pts. the
z value is $z = 4x^2$ and $0 \leq z < \infty$.
It follows (since $4x^2 + 9y^2 \geq 0$) that
the Range of f is $0 \leq z < \infty$.

23) $f(x,y) = \dfrac{1}{\sqrt{16 - x^2 - y^2}}$

a.) Domain : $16 - x^2 - y^2 > 0$
$\rightarrow$ $x^2 + y^2 < 16$ so
domain is set of pts.
(x,y) inside the circle

$x^2 + y^2 = 4^2$

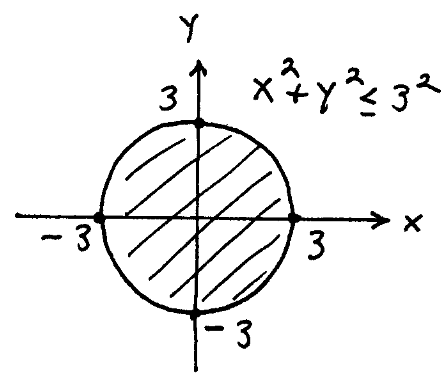


b.) Consider all pts. $(x,0)$, where $-4<x<4$; for these pts. the z-value is $z=\dfrac{1}{\sqrt{16-x^2}}$; note that $z=\frac{1}{4}$ if $x=0$ and

$$\lim_{x\to 4^-} z = \lim_{x\to 4^-} \frac{1}{\sqrt{16-x^2}} = \frac{1}{\sqrt{0}} = +\infty \; ;$$

the z-values range for $z=\frac{1}{4}$ to ∞; since $\frac{1}{4} \le \dfrac{1}{\sqrt{16-x^2-y^2}}$, it follows that the Range of f is $\frac{1}{4} \le z < \infty$.

24) $f(x,y) = \sqrt{9-x^2-y^2}$

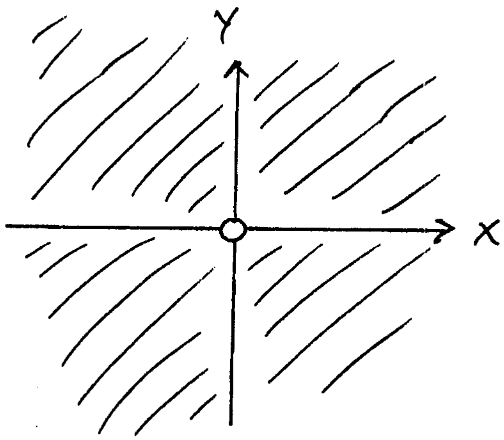


a.) Domain: $9-x^2-y^2 \ge 0$ $\rightarrow$ $x^2+y^2 \le 9$ so domain is set of all pts. (x,y) on or inside the circle $x^2+y^2=3^2$

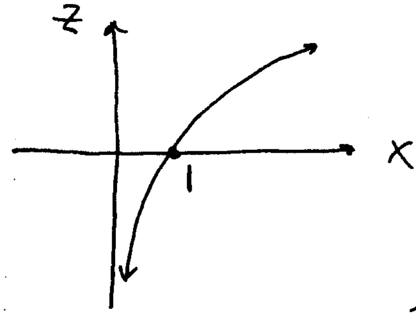
b.) Consider that $z=\sqrt{9-x^2-y^2}$ $\rightarrow$ $z^2 = 9-x^2-y^2$ $\rightarrow$ $x^2+y^2+z^2=3^2$ is a sphere of radius 3 centered at $(0,0,0)$; the $z=\sqrt{9-x^2-y^2}$ is the top half of the sphere, so the Range of f is $0 \le z \le 3$

25) $f(x,y) = \ln(x^2+y^2)$

a.) Domain: $x^2+y^2>0$ so domain is set of all pts. (x,y) except $(0,0)$;



b.) Consider all pts. $(x, 0)$, where $0 < x < \infty$; for these pts. the z-value is $z = \ln x^2 \rightarrow z = 2 \ln x$;



these z-values range from $-\infty$ to $+\infty$; it follows that the Range of f is $-\infty < z < \infty$.