

9/9/14 MATH 2850

Chapter 14

Ch. 13 review:

$$v: \mathbb{R} \rightarrow \mathbb{R}^3 \leftarrow \text{functions}$$

Ch. 14 functions $f: \mathbb{R}^3 \rightarrow \mathbb{R}$

Calc. I

functions $g: \mathbb{R} \rightarrow \mathbb{R}$

ways to describe a function

- ① table of values
- ② formulas
- ③ Pictures (graphs)

①

x	0.0	0.1	0.2	...
$g(x)$	5	-21	7	...

② $g(x) = x^2 - 2x + 1$

$$h(x) = \begin{cases} 0 & \text{if } x \text{ is rational} \\ 1 & \text{if otherwise} \end{cases}$$

Ex: $f(x, y) = x^2 - y^2$

graph: $z = x^2 - y^2$

hyperbola $z=0$

$$x^2 - y^2 = 0$$

$$x^2 = y^2$$

$$|y| = |x|$$

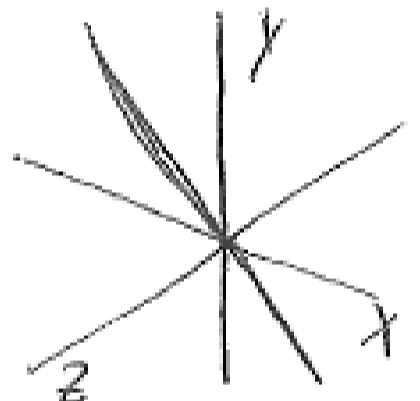
$$y = \pm x$$

$$\frac{z=1}{x^2 - y^2 = 1}$$

$$x=0 \quad -y^2 = 1$$

$$y=0$$

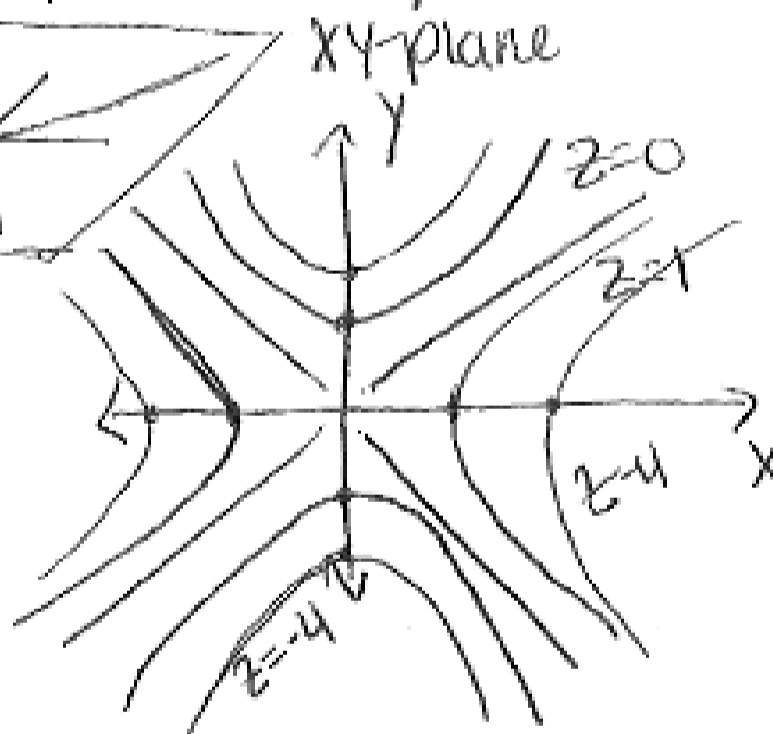
$$x^2 = 1$$



level curves

$$\frac{z=-1}{x^2 - y^2 = -1}$$

$$x^2 - y^2 = -1$$



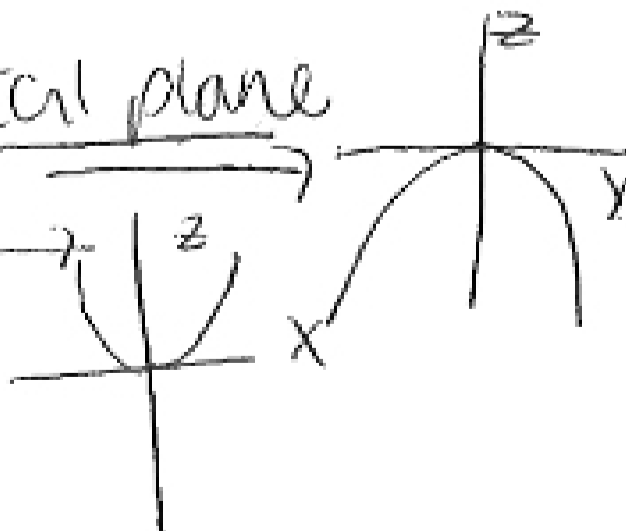
$$\frac{z=4}{x^2 - y^2 = 4} \\ x^2 = 4$$

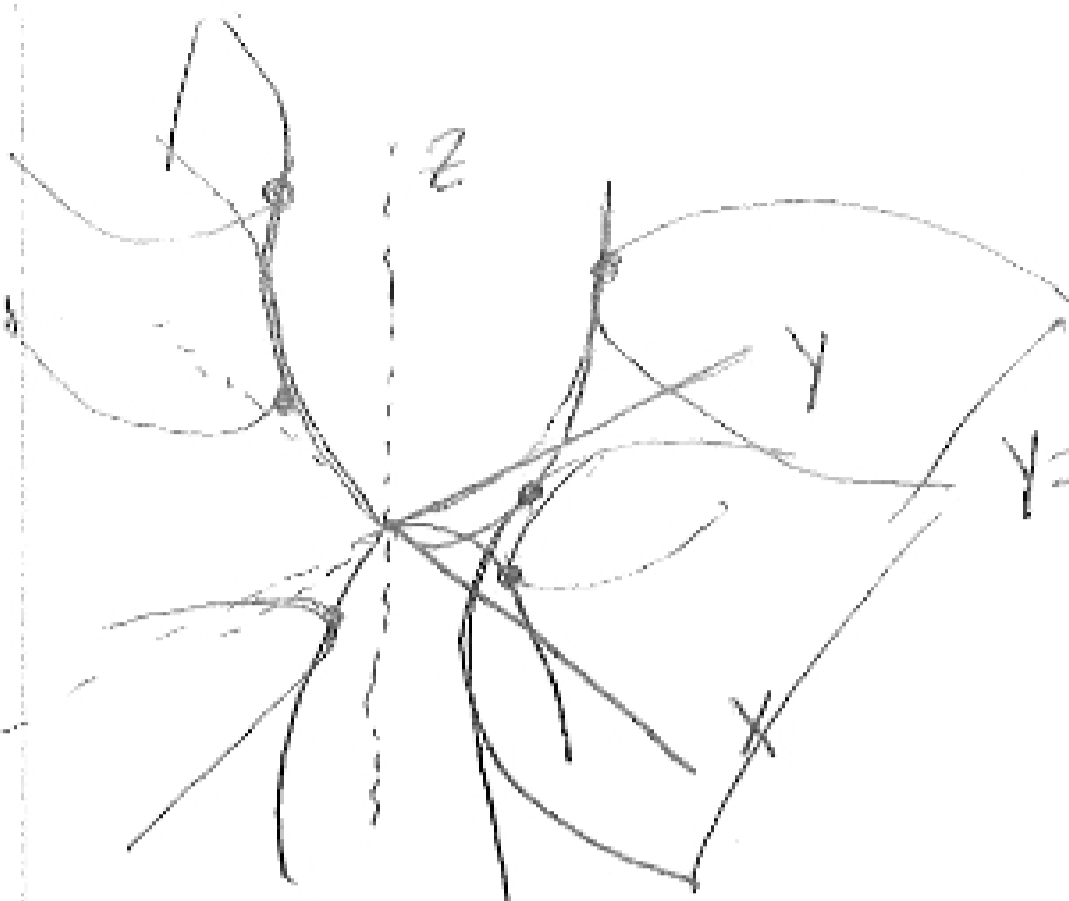
Equation of a vertical plane

$$x=0 \leftarrow z=0=y^2$$

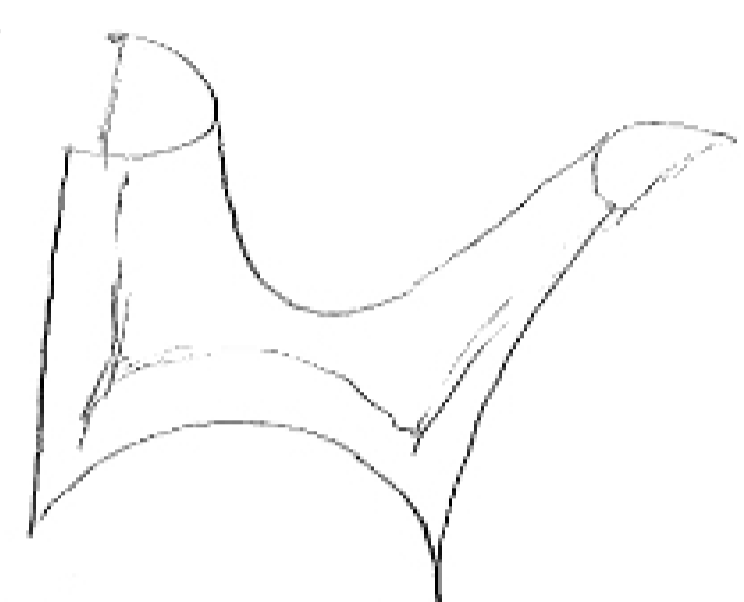
$$y=0 \quad z=x^2=0$$

$$x=y$$





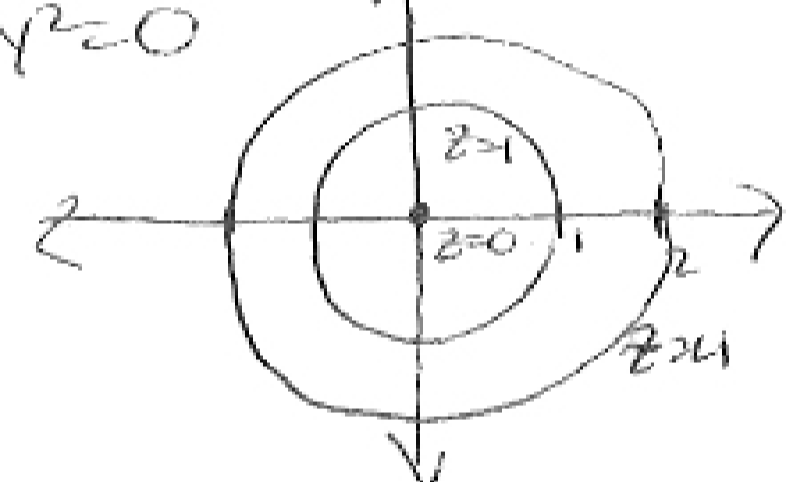
$$y=0 \quad z=x^2-0$$



ex: $F(x,y) = x^2 + y^2$
 $z = x^2 + y^2$

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

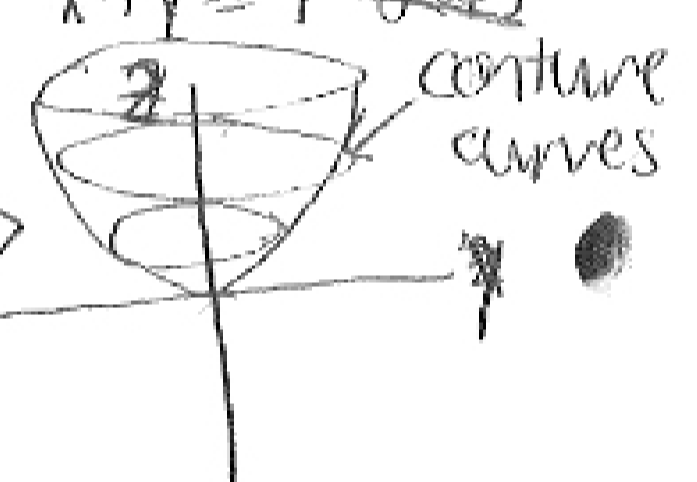
level curve



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

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

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



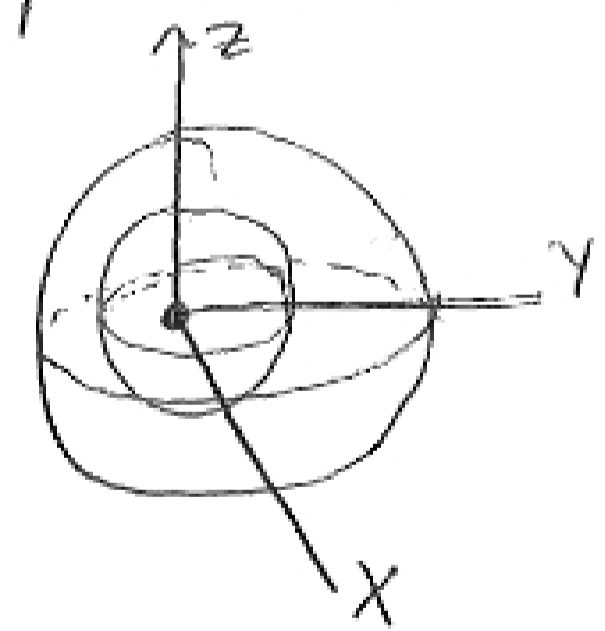
ex: $F(x,y,z) = x^2 + y^2 + z^2 = w$

level surfaces

$w=0$
 $x^2 + y^2 + z^2 = 0$

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

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



graph:

- $y = f(x) \Rightarrow$ curve
- $z = f(x,y) \Rightarrow$ surface
- $w = f(x,y,z) \Rightarrow$ 3 dimensional thingy

Ex: $f(x,y) = \ln(x^2+y+z^2)$

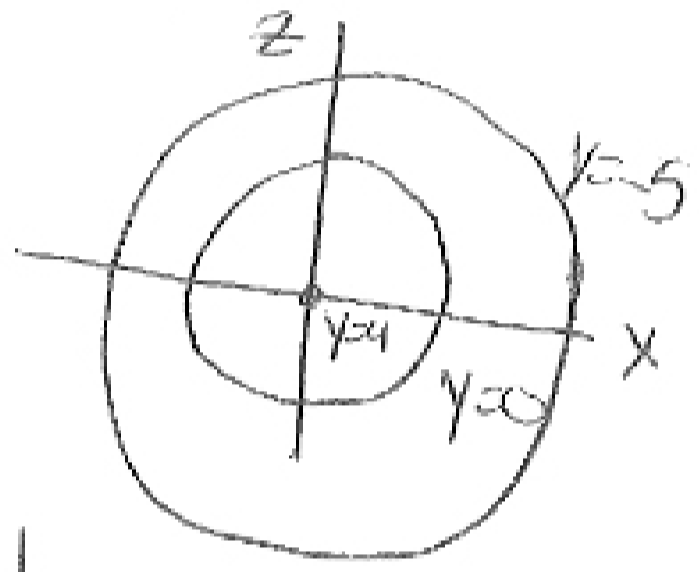
level surface through $(-1, 2, 1)$

$\ln(4) = \ln(x^2+y+z^2)$
 $e^{\ln 4} = e^{\ln(x^2+y+z^2)}$

$4 = x^2+y+z^2$
 $y = 4 - (x^2+z^2)$

$\ln(1) = 0$
 $\ln(e) = 1$
 $\ln(e^2) = 2$

$y=0$
 $0 = 4 - (x^2+z^2)$
 $4 = x^2+z^2$



$y=4$
 $4 = 4 - (x^2+z^2)$
 $x^2+z^2 = 0$

$y=5$
 $5 = 4 - (x^2+z^2)$
 $x^2+z^2 = -1$

$y=5$
 $5 = 4 - (x^2+z^2)$
 $x^2+z^2 = -1$

$z=0$
 $y = x^2+y$
 ~~$y = x^2+y$~~
 $y = 4 - x^2$

